the OIL AND GAS JOURNAL
PUBLISHED WEEKLY JULY 18, 1960

Who'll buy and transport

ALBERTA'S SURPLUS LPG?

p. 57

How the presidential candidates stand on oil ▶ 62

Ohio market opening to Gulf Coast refiners ▶ 64

Gulf tells how it drilled a mile a day ▶ 66

New variable-diameter pipeline scraper ▶ 94

West Africa's forgotten basin: Ghana's Voltaian ▶ 146

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Sounds ridiculous we know, but we hope Halliburton Experimental Well No. 5 never makes one drop of oil . . . because this well is a part of our research and pretesting of the tools, equipment, and techniques that you constantly are asking for.

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OIL AND GAS JOURNAL
Vol. 58, No. 29

Contents July 18, 1960

THE WEEK'S NEWS

General Interest:
Richardson LPG-Storage Case May Be Settled Out of Court . . . 60
How the Candidates Stand on Oil Issues . . . 62
Says Billups: Gasoline CAN Be Profitable . . . 70
Indiana Standard Completes Corporate Reorganization . . . 75

Pipelining:
Market for Surplus LPG Is Big Question for Alberta . . . 57
Pipeline Tie-in Links Gulf Refiners to Ohio Market . . . 64
Pipeline Briefs . . . 70

Processing:
OCAW Locals Will Soon Ask 18-Cent Wage Increase . . . 60
Petrochem Output Expected to Go Even Higher This Year . . . 61
New Firm Formed to Make Synthetic "Natural" Rubber . . . 68
Processing Briefs . . . 68
D-2 Committee Asks New No. 2 Fuel-Oil Specs . . . 70
Refiners Ask Los Angeles to Take Another Look at Smog Rules . . . 72

Foreign News:
India Seeks Russian and Western Help in Oil Program . . . 80
European Turkey May Have First Discovery . . . 80
Soviet Oil Arrives in Cuba, Jersey Warns Tanker Owners . . . 82
Patent Fight Over Polypropylene Processes Shapes Up in Japan . . . 82
Bahrain Petroleum Plans Persian Gulf Test . . . 83
Europe's First International Crude Pipeline Begins Operations . . . 84

Drilling-Production:
Record Drilling Speed Is Gulf's Answer to Higher Costs . . . 66
California's Grimes Field Has Good Gas Well . . . 72
Record Pay Found in Canada's Dick Lake Area . . . 74
Loffland Cuts Costs With Two Rigs in One Derrick . . . 76

Exploration:
Interior Sets Stage for Exploration Off Atlantic Coast . . . 60
Commercial Scouting May Spread Still Further . . . 74
Intex Makes Five Strikes in a Row on Rim of San Juan Basin . . . 141
Electric-Log Evaluation May Lead to Strat Traps . . . 142
Ghana: Promising Western Africa Oil Area . . . 146

REGULAR FEATURES

Advertisers' Index . . . 165
Book Review . . . 115
Calendar of Events . . . 44
Classified Advertising . . . 162
Deaths . . . 156
Discovery Wells . . . 152
Drilling Contractors . . . 138
Drilling Statistics . . . 158
Editorial . . . 53
Equipment Men . . . 134
Exploration Highlights . . . 141
Foreign News . . . 80
Foreman's Page . . . 102
Journally Speaking . . . 51
Markets . . . 161
New Equipment . . . 125
On the Job—Pipelining . . . 121
Personals . . . 153
Production . . . 159
Refining Statistics . . . 160
Statistical Summary . . . 157
Technical Questions . . . 110
The Journal Said . . . 51
They Say . . . 40
Trade Literature . . . 133
Watching Washington . . . 78
Who's Who in Oil . . . 153

Technology-Operation section on next page →

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TECHNOLOGY—OPERATION

Drilling-Production

How Operating Conditions Affect Miscible-Flood Design **97**

By W. E. Brigham and J. N. Dew

Design of miscible-flood systems depends on these factors: (1) miscible conditions must be maintained to prevent drastic reduction of recoveries; (2) recovery efficiency should be calculated in a manner similar to water flooding; (3) proper slug size seems to be 5% of hydrocarbon pore volume; (4) miscible process seems most attractive for low-viscosity oil in tight or water-sensitive reservoirs; and (5) economics must be compared with other secondary recovery techniques.

Slim-Hole Completions Reduce Well Costs 35% **96**

By James G. Bonsall

Maximum saving on 36 small-diameter wells drilled by Hudson's Bay Oil & Gas Co. was 42% compared to conventional wells drilled within a ½-mile radius in Pembina field. The average saving of 35% results when comparing the actual costs of slim holes to offset conventional holes.

One-Trip Sampler Is Real Time Saver **111**

By Pat Chisholm

A single tool, the multiple-zone sampler, now combines the advantages of the regular packer-type drill-stem test as well as the wire-line tester. It gets fluid and pressure from several zones for a small cost in rig time.

Reservoir Engineering—No. 25 ..... **113**

By E. T. Guerrero and F. M. Stewart

How to make use of capillary-pressure data.

Oil-Well Pumping—No. 6 ..... **116**

By Joseph Zaba

How to measure pumping loads.

Pipelining

New Variable-Diameter Pipeline Scraper Saves $200,000 ..... **94**

By Paul Reed

This new tool developed by Service Pipe Line Co. is much more than just an improved tool for doing better work on regular schedules of routine operations. An unusual feature provides for holding cleaning knives firmly against the interior of the pipe wall.

Black Box Determines Jet-Fuel Cleanliness **121**

By C. L. Heaberlin, J. M. Fraser, and J. Walker

Impurities show up as tiny white dots in this quick, accurate procedure.

Refining-Processing

How to Measure Tube-Wall Temperature **100**

By F. S. Becker and F. M. Kepler

Proper measurement will enable the operator to maintain high production and prolong onstream time. Proper location and installation of thermocouples will help him get temperature measurements that mean something. And, when used properly, these temperatures will provide useful operating guides.

The Foreman's Page **102**

Energy principles for refinery use.

New Digital System Permits Continuous In-Line Stock Blending **104**

This more efficient blending operation cuts off-specification product, minimizes storage and operating costs, and simplifies mixing of the steadily increasing number of blending stocks and additives.

New Slide Valve Is Compact, Versatile **106**

With proper type of pilot system, this valve can operate almost anywhere a gas valve is needed. It can be manually, pilot, or instrument operated.

Questions on Technology **110**

Does it pay to desulfurize middle distillate?

General

How Sohio Trains Supervisors in Labor Relations **108**

By James J. Bambrick

Basic course consists of five 2-hour sessions. Each session consist of a lecture followed by a discussion. The course is given to all line management from foreman to refinery manager.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
July 18, 1960

Oil's political outlook for 4 years is taking shape:

Feeling is the industry will face somewhat tougher sledding in Washington if Kennedy is elected in November.

Democratic nominee is not openly hostile to oil but he consistently has voted against the industry in almost every oil and gas issue (p. 62).*

The outlook under Kennedy:

Not likely to advocate cut in percentage depletion but probably wouldn't veto such a bill.

Probably will keep silent on natural-gas legislation.

Probably advocate continuation or even increase in the federal gasoline tax.

Three planks in Democratic platform obviously are tied to oil. They promise:

...Practical measures to protect industries hurt by increases in imports.

...Close tax loopholes (depletion is so regarded).

...Step up research on air-pollution problems.

If Nixon should win, industry can expect about the same treatment it got from Eisenhower.

He has made public statements clearly indicating views similar to Eisenhower and, being from California, he has a little more oil awareness.

Nixon administration, therefore, likely would mean a mild resistance to any legislation materially affecting industry.

▼ ▼ ▼

Here's the drilling strategy of Gulf engineers that resulted in record 5,412-ft. of hole in 24 hours:

The 9⅞-in. bit whirled at 225 rpm. Weight was 60,000 lb. Jet velocity reached a bottom-blasting 510 ft. per second. A 2,000-hp. pump ran against 3,500 psi. to circulate 620 gpm. for annular velocity of 220 ft. per second.

The speed is no fluke. Gulf engineers have quarterbacked a whole series of speed trials (p. 66).

---

*Refers to article in this issue giving more details. Where no page is given, the item is a Newsletter exclusive.

Two rigs on a single derrick are giving unusual versatility in offshore drilling for Loffland Brothers.

Under this 2-in-1 system, a drilling crew can complete or work over one well while drilling another on the same derrick floor.

Efficiency and economy of the idea are being proved on a Louisiana program of drilling 18 directional wells from one platform (p. 76).

▼ ▼ ▼

Remote wildcat is being planned in Oregon by Humble. Rig is being moved into the south-central part of the state for a 12,000-ft. test. Nearest production is 250 miles away in northern California.

Humble has been working more than a year to assemble the acreage and has several thousand acres in the Lake County area. Location will be Section 18-36s-18e, about 30 miles north of the California border and 22 miles northwest of Lakeview. Sun Drilling Co., Los Angeles, has the contract.

In a move to recover funds to use in exploration, drilling, and other operations, Skelly may put its new 17-story Tulsa building on the block. Price tag is about $13 million.

Five investors reportedly are interested in the deal that includes Skelly's taking a long-term lease.

Phenomenal success record is being made in Oklahoma's Kingfisher County. So far this year, eight out of 10 wildcats have hit while 32 field wells have been producers out of 32 drilled.

Newest strike is Jones & Pellow 2-B Schimanek in East Hennessey field. It flowed at rate of 1,240 bbl. daily from Manning Mississippian at 6,532-40 ft. on 20/64-in. choke and 1,680 bbl. daily from Meramec at 6,755-70 ft. on open hole.

▼ ▼ ▼

Indiana Standard is shifting its refining, marketing, and transportation operations under the Amoco banner.

Transfer of operations to its subsidiary, American Oil Co., will leave the big parent company free to concentrate on deciding policy, guiding and coordinating activity of affiliates, evaluating performance, and planning for future. Move climaxes a 6-year reorganization program (p. 75).

In another move in marketing, Indiana Standard has bought Great American Oil Co. of Chicago, a distributor. Operations will be continued under the same name.

Other sales rumors:

Douglas Oil of California is still being wooed by several majors but spokesman says there are no hot deals at present. Merger talk cropped up at stockholders meeting last

week when executives reported gasoline sales are booming and an aggressive service-station building campaign is continuing.

Humble move into Missouri with purchase of Simpson Oil Co. of St. Louis is now being talked. Simpson is independent marketer, operating a chain of cut-rate stations.

▼ ▼ ▼

Strange twist: Refiners cut runs 15,000 bbl. daily in latest week, but output of finished products increased by almost 146,000 bbl. daily.

Answer to the riddle: Refiners just changed unfinished oils into finished products. Market effect is the same as if they had run the crude.

Average runs for week were 8,280,000 bbl. daily, still up 445,000 bbl. daily over early June average.

Economic quarantine for independent tanker owners who participate in the Russia-Cuba trade is developing. (p. 82).

Warnings have been issued by Jersey Standard that tanker owners face loss of Esso business if they charter or sell ships to Soviets or Cuba. Jersey is one of world's biggest users of tankers.

Texaco officials have indicated they will be very "disappointed" if their business friends do business with Cuba.

Production of basic petrochemicals is approaching the 30-billion-pound mark this year.

This bright outlook stems from U. S. Tariff Commission report that petrochemicals enjoyed a 16% production jump in 1959.

Last year's production was 24.3 billion pounds compared to 20.9 billion the year before. Ethylene still retains the title as champion in petrochemical production with propylene second (p. 61).

▼ ▼ ▼

A sudden glut of natural-gas liquids will show up in Alberta late next year if all the proposed plants to process gas for export are built by then (p. 57).

Four plans are pending for pipelines to move the big volume of liquids. But the big question is: Who will buy the surplus outside of Alberta? A controversy over where the liquids go will involve sections on both sides of the U. S.-Canada border.

New internal cleaning and coating technique for pipelines has been tested on a Permian Basin Pipeline gas line at Hobbs, N. M.

This new in-place method, based on mechanical cleaning and spray coating, is designed to increase throughput and reduce maintenance of pipelines already installed. The test drew top engineers from most major gas lines and also several oil lines as well.

Market Memo

July 18, 1960

Crude runs remind us of "keeping up with the Joneses." About the time the Smiths catch up with the Joneses the Joneses refinance.

Refiners are like that. About the time posted prices are increased, they increase runs.

Crude runs to stills for early July started quiet buyer huddles in the market place. Where two or more buyers congregate—at Club 21 over lunch, in company hallways, or at cocktail parties—the one question: What will be the price of No. 2 in November if present higher-than-necessary crude runs are continued?

Buyers will be reluctant to make forward purchases of gasoline and middle distillates in view of the trend.

Gulf Coast markets are firm across the board now.

No. 6 features in strength at posted $2.20 per barrel for Bunker C. If price alone would bring out needed Bunker C, the fuel price would increase.

No. 2 in the Gulf Coast is very firm at posted 8.25 cents with sellers reluctant to sell at that price, expecting another price advance.

Gulf Coast gasoline is being sold at 11 cents for cargo lots of 92 RON.

Mid-river points on the Mississippi find gasoline closely held for the balance of July.

Refiners are in good shape on inventories compared with this time last year. Gasoline prices range from Gulf Coast low up to three-eighths cent over the low, depending on delivery point on the river. This prices 92-RON gasoline today at 11 up to 11.375 cents per gallon.

Middle distillates from the same area are being firmly priced but sparingly offered at present. Gulf Coast low of 8.25 cents to an asking price of one-quarter cent over that figure for No. 2 is indicative of the product's strength.

Chicago gasoline prices have not followed the price advances which have prevailed during recent weeks for gasoline out of Group 3 for northern shipment. Thus 91-RON gasoline is posted at 12 cents in Chicago as well as out of Group 3 for northern shipment. It follows that an increase is imminent and justified in Chicago.

Middle distillates in Chicago are strong at posted lows of 9.75 cents for No. 1 and 9 cents for No. 2.

Group 3 prices on all products for shipment north are firm at current postings—91 RON at 12 cents for resale, No. 1 at 9 cents and No. 2 at 8 cents.

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NEW MEXICO — Farmington, Lovington
OKLAHOMA — Duncan, Oklahoma City, Pauls Valley, Sapulpa, Tulsa
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plant facilities and capacity

in choosing a pipe coating contractor?

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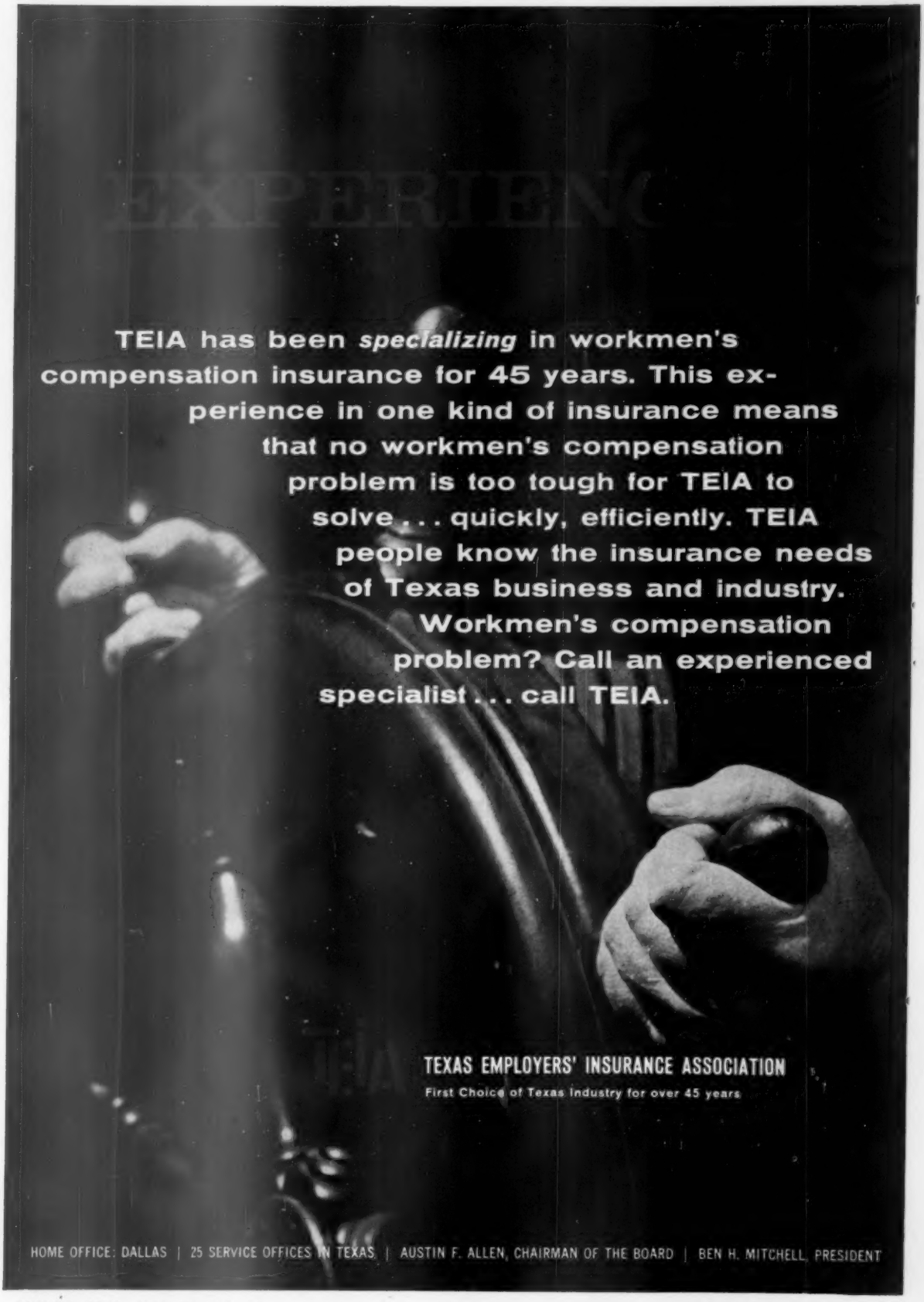
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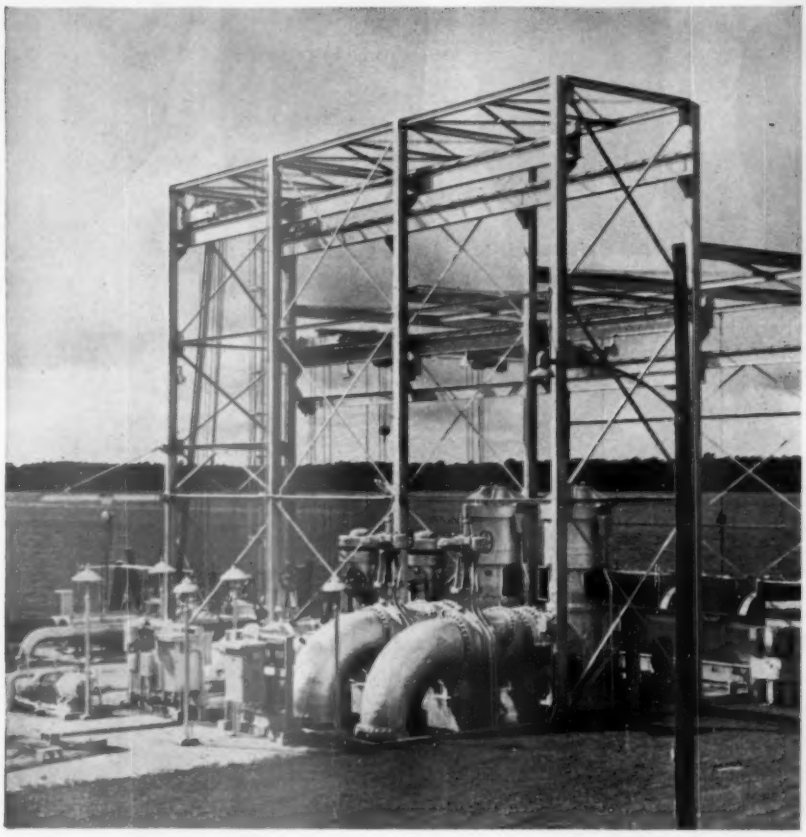
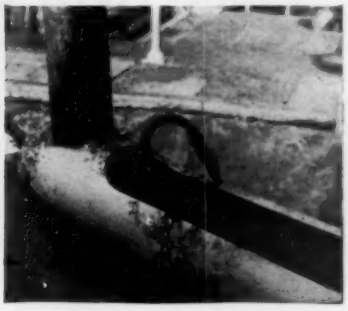
News about

B.F.Goodrich Chemical *raw materials*



Florida Power & Light Company uses anode racks made of Geon vinyl pipe. Fabricated by F P & L plant personnel at this job. B.F.Goodrich Chemical Company supplies the rigid Geon vinyl. These photos show intake structure at Palatka plant on St. John River, one of many places anode racks of Geon are used.



FP&L fights underwater corrosion with anode racks of rigid GEON

Underwater steel structures corrode when they are attacked by galvanic currents. Florida Power & Light engineers solve the problem two ways. They reduce effect of galvanic currents with an opposing voltage and they suspend anodes of graphite to bear the brunt of any continuing flow. These anodes rest in frames made of rigid Geon pipe.

Vertical side frames are 2" Geon pipe and trays are open sections of 5" pipe. The only effect on the racks of Geon is the marine growth shown in the photo at upper right. This growth is easily washed off, as photo at lower right shows.

Here's another example of the way Geon vinyl can solve corrosion problems for utilities. As pipe, as conduit, or as coatings, you'll find Geon vinyl is often the answer to your corrosion problems. For more information, write Dept. GR-4, B. F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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B.F.Goodrich Chemical Company
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BETTER drilling rates in all types of muds: T-8, lime, gyp, and low pH, with varying amounts of oil.

BETTER (lower) barite requirements when substituted for oil in muds.

BETTER hole lubrication, in all types of muds, to reduce pipe sticking.

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BETTER geological interpretation and electrical logs; no fluorescence.

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MAGCOBAR PLANNED MUD PROGRAMS make the above statements facts, not claims. In high weight emulsion muds, for example, the Magcobar engineer properly substitutes Bit Lube® for some of the oil to cut drilling costs by reducing the amount of barite required. In a typical well, the oil content of the mud was allowed to drop from 11 to 5 per cent. Bit Lube was added to this 17.8 lb./gal. lime mud with these savings in barite:

	Sacks of barite per day	Cost of barite per day	Cost of Bit Lube per day	Cost of Oil per day	Total Cost per day
Emulsion (2 week average)	177	$409.76	$—0—	$74.03	$483.79
Bit Lube and Emulsion (3 week average)	52	120.38	122.43	8.25	251.06

NET DAILY SAVINGS WITH BIT LUBE: $232.73

Not only does Bit Lube give direct cost savings, but it also offers escape from costly pipe sticking, even in extreme directional holes. Bit Lube lowers the friction coefficient of the mud, to give over-all higher drilling mud performance. These savings can be added to those in the chart.

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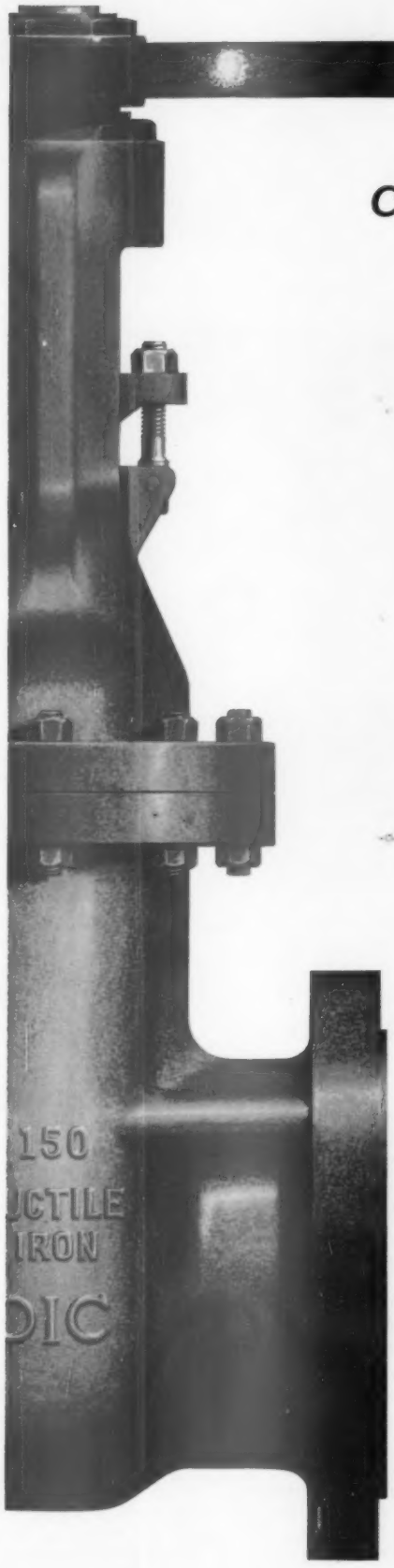

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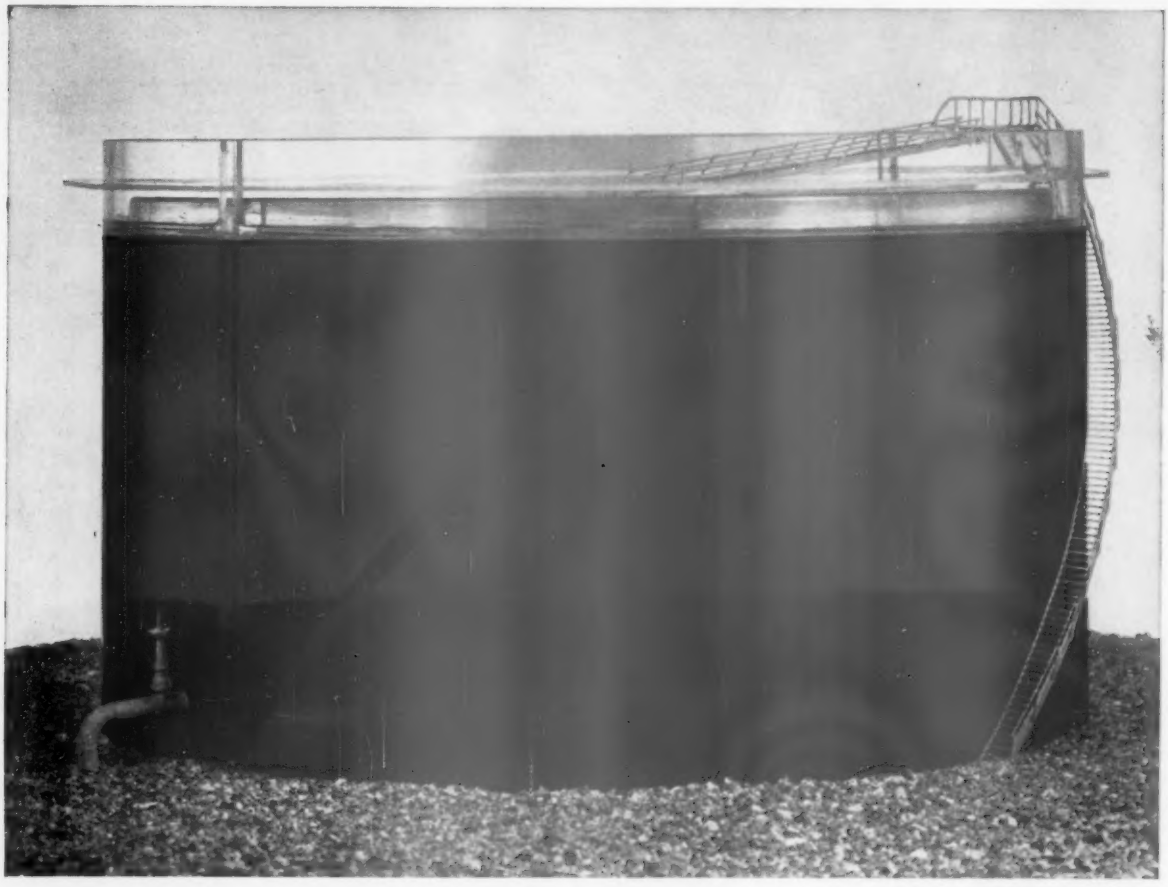
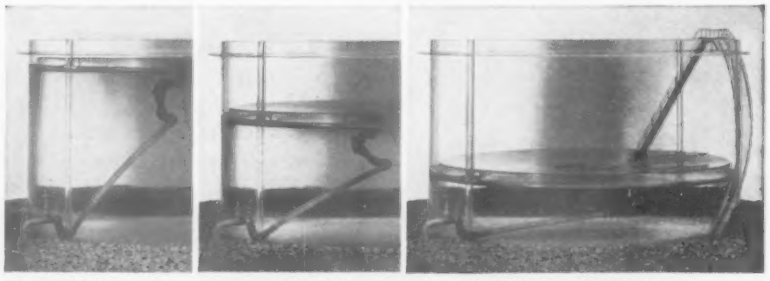


Chiksan Swivel Jointed Drain Lines team up strength + flexibility + endurance

The unlimited flexibility of Chiksan swivel joint equipped floating roof drains mean money saved on every tank. First, Chiksan drains cost less than rubber hose —and, you count their useful life in years instead of months. Chiksan swivel joints and lines easily withstand tank pressures —never kink to cause drain stoppage. Both lines and joints are available in many types of metals to meet specific liquid storage requirements.

Plan now to include Chiksan drain lines in all new tank installations and in present lines that need replacement. For details, contact Chiksan or your nearby Chiksan field representative.



FULL TANK. Drain line flexes readily. Easily withstands tank pressures.

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CHIKSAN COMPANY—Brea, California • Chicago 5, Ill. • Newark 2, N. J. • Divisions: Chiksan International, Hamer Valves, Weco • Subsidiary: Chiksan of Canada Ltd.

Photographed at Shell Oil Company (Houston, Texas, Refinery)

Cyanamid met a need... and produced the first successful 25% alumina catalyst

A few years ago, cooperation between a major refiner and Cyanamid went far beyond meeting the demand for continuously superior fuels. It developed a milestone in catalyst chemistry—fluid cracking catalyst AEROCAT TRIPLE A®, the first commercially successful 25% alumina catalyst.

AEROCAT TRIPLE A combines unusually high activity and stability for premium cracking efficiency. These properties provide high equilibrium activity and contribute to increased conversion at lower temperatures or reduced catalyst usage at severity levels required for low alumina catalysts.

Cooperating with refiners is the most important part of Cyanamid's service. The skill and experience of your Cyanamid salesman—the Man with the Golden Rule—are supported by the resources of a major catalyst producer that is also a major manufacturer of other chemicals. Call your Cyanamid representative whenever you need his cooperation.

Basic in catalyst chemistry

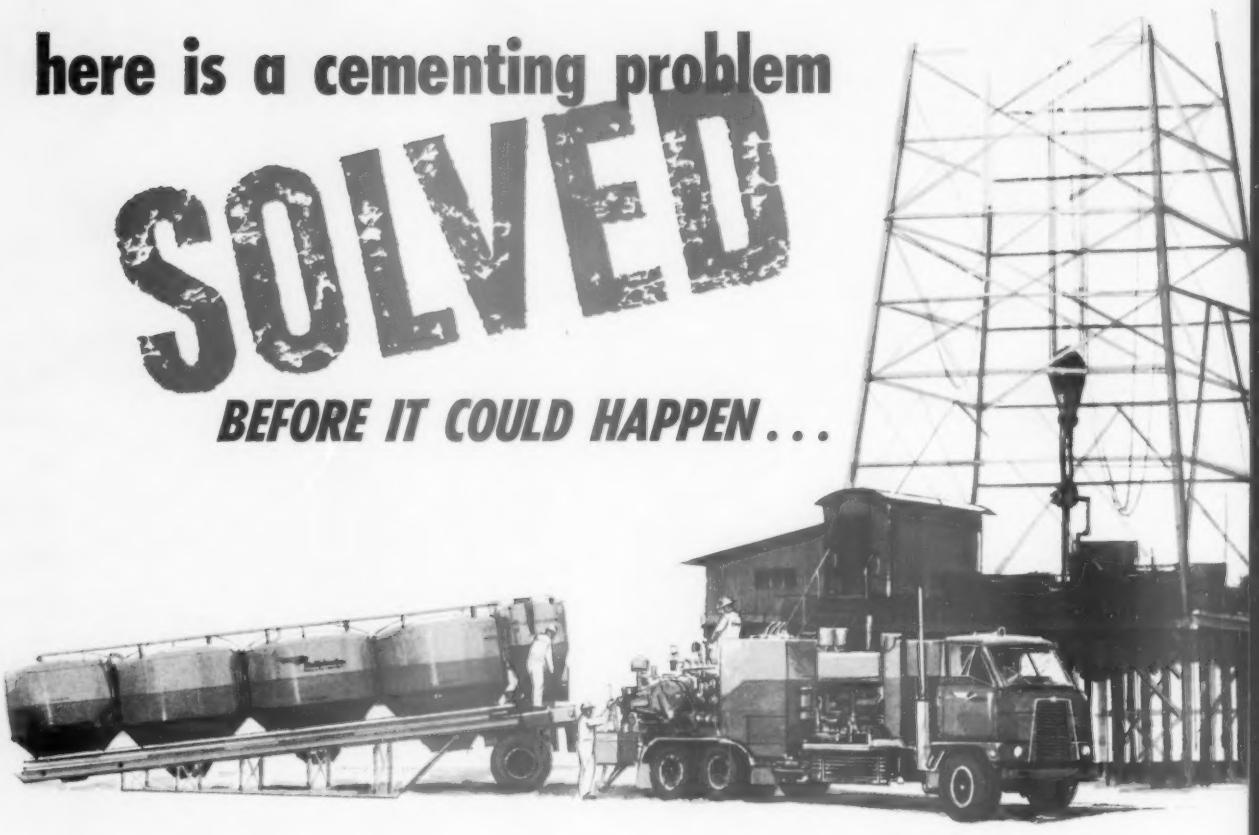
CYANAMID

AMERICAN CYANAMID COMPANY • REFINERY CHEMICALS DEPARTMENT • 30 Rockefeller Plaza, N. Y., 20. N. Y.

here is a cementing problem

SOLVED

BEFORE IT COULD HAPPEN . . .



Imagine this well is yours. You're skeptical because of this formation's history . . . drilling returns, core samples – everything points to probable trouble . . . severe lost circulation during cementing. That's your problem – and here's how you handle it:

FIRST call in your Halliburton man to help select the best combination of materials and equipment you will need for the job.

The Halliburton man explains how GILSONITE is designed to lighten slurry density to help protect those weak formations from the hydrostatic head of the cement . . . *and* he points out the excellent bridging characteristics of GILSONITE which will help control any breakthrough that might occur. You then select GILSONITE to help control the circulation losses you expect.

NEXT you pick the right equipment – Halliburton Bulk Handling Equipment to provide up to 1,250 cu. ft. of cement from each unit – at speeds up to 40 sacks per minute without bothersome sack handling, spillage, or breakage. For smooth, dependable placement of the slurry, you choose Halliburton HT-400 Pump Trucks – giving you the capability to do the job *well*, and plenty of power in reserve.

SO YOU'VE SOLVED TODAY'S PROBLEM

but what about tomorrow . . . and the day after that . . . here's the answer . . .

DEPEND ON HALLIBURTON SPECIAL CEMENTS AND ADDITIVES IN ANY APPLICATION INTENDED FOR THEIR USE

for instance . . .

LATEX CEMENT – excellent for use in cementing through permeable zones. The low fluid loss qualities of Latex Cement help limit the amount of cement filterate entering into the producing strata.

POZMIX CEMENT – to provide maximum protection against corrosion, contamination and poor bonding between pipe and formation. For average depths and temperatures, Pozmix "A" and "S" provide superior qualities such as light weight slurries, low permeability and improved pumpability. Deeper, hotter wells call for Pozmix 140 which gives strength stability in well temperatures up to 400° F.

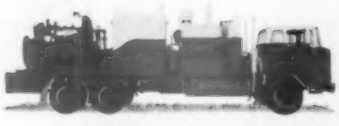
GEL-CEMENT – Halliburton HOWCOGEL helps lower fill-up costs by increasing slurry volume through the water absorption qualities of this material. This also lowers slurry weight to help protect weak formations from the load of a heavier cement column.

RADIOACTIVE CEMENT – provides you with the important ability to survey the condition of the job after completion. Accurate measure of the top of cement, location and disposition of squeeze cement, general condition of cement around specific zones, and other valuable knowledge.

RESIN-CEMENT – is widely used to help control production of unwanted water or gas. A mixture of resins, water and portland cement, this product helps seal off troublesome formation intervals by forming an impermeable bond in the zone adjacent to the plug in the well bore.

Continue to look to Halliburton for leadership

The dependability of these Halliburton products is matched by the experienced performance of the Halliburton specialists who help you use them. Ask your Halliburton Representative to recommend the *best* combination of men, materials and equipment to handle your next cementing job.



HALLIBURTON

CEMENTING SERVICES

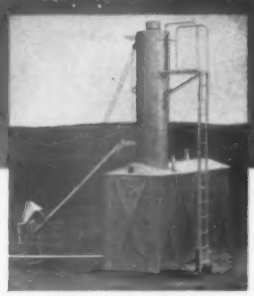
HALLIBURTON COMPANY • DUNCAN, OKLAHOMA

Proven

IN OVER 600 INSTALLATIONS

ROLO'S CALCIUM CHLORIDE

Gas Dehydrator*



--the revolutionary dehydrator that requires no pump or process heater

The San Juan Basin, Big Piney and the provinces of Alberta and Saskatchewan are among the cold weather areas that have served as proving grounds for the Rolo $CaCl_2$ Gas Dehydrator. Under wintery conditions, efficient gas dehydration is all the more essential, but far more difficult to achieve. Yet, the hundreds of Rolo Units in these areas have performed with marked success.

The Rolo Calcium Chloride Gas Dehydrator employs a long-lasting bed of calcium chloride to remove water vapor from gas streams. Top efficiency is obtained by utilizing the brine, in a series of patented jet trays, to pre-dehydrate the gas before it contacts the chemical bed.

Advantages over competitive systems:

SIMPLICITY . . . No pumps, since regeneration is not required. Only moving parts are the level controls.

LESS HAZARDOUS . . . No process heat required, since there is no regeneration.

ATTENDANCE-FREE . . . Absence of pump and regenerative heater allows unattended operation for long periods—especially important in cold areas and offshore.

LOW OPERATIONAL COST . . . Cost per MMCF is low in comparison with other systems.

LOW INITIAL COST . . . Get our prices and compare.

MAXIMUM DEWPOINT DEPRESSION . . . The ability of calcium chloride as a dehydrating agent, especially with utilization of the brine, is unequalled in water vapor removal.

INTEGRAL SCRUBBER . . . Standard on all models; removes free liquids from the incoming stream.

BETHLEHEM STEEL

Contact your nearest Bethlehem representative for information and prices on Rolo products.
In California, Howard Supply Company. In Canada and for export, see below.

ROLO

BETHLEHEM STEEL COMPANY
SUPPLY DIVISION
General Offices: 21 E. Second St., Tulsa, Okla.

ROLO MANUFACTURING COMPANY
P. O. Box 22126, Houston 27, Texas
Canada: Petro-Automation Industries, Ltd., Edmonton, Calgary and Regina
Export: R. S. Stokvis & Sons, New York, N. Y.

*Originated by Fish Engineering Corporation

FR®

—standard on LINK-BELT oil field roller chain

FATIGUE RESISTANT

U. S. Patent No. 2,517,497

Fatigue Resistant processing of sidebars develops greater dynamic strength for hard-working oil field drives . . . increases endurance limit

No ordinary roller chain can long withstand the brute punishment of drilling service. That's why Link-Belt adds the FR process—a proven way to promote longer chain life. By compressing the metal around pitch holes, Link-Belt greatly strengthens the critical sidebar areas most vulnerable to fatigue . . . thus creating extraordinary *dynamic strength*.

And FR is just one of many Link-Belt "extras":

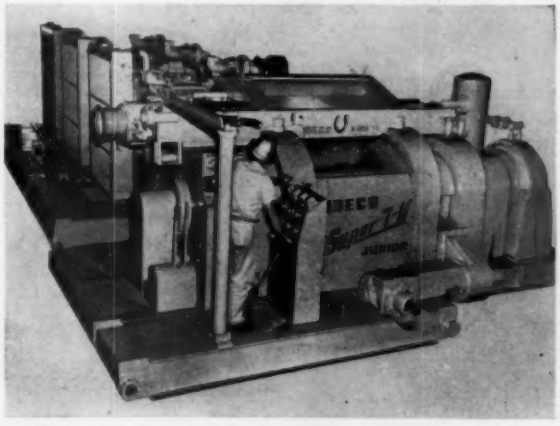
- SHOT-PEENED ROLLERS
- SHEPHERD'S CROOK COTTERS
- PRE-STRESSING
- CLOSER HEAT-TREAT CONTROL
- E-Z ASSEMBLY
- DOUBLE BOXING

Any leading supply store in the field can give you full details and a copy of Link-Belt Catalog 2980.

LINK-BELT

ROLLER CHAINS & SPROCKETS

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 21, Odessa, Tex., Shreveport, La., Los Angeles 33, Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields. 10.141



NEW IDECO JUNIOR SUPER 7-11 is equipped with Link-Belt multiple-width precision steel roller chain with "FR". *Since this feature involves no alterations in dimensions of chain parts, Link-Belt roller chain is interchangeable with standard chains and sprockets.*

New time multiplexing and remote and reduce line requirements for

Five new basic time multiplexing systems—and a new remote index setting feature—add to the overall versatility of *Dur-O-Pulse* . . . give you advantages available in no other telemetering system.

With Time Multiplexing Units—

- You can transmit up to 15 signals either in one or two directions over a single channel.
- You can add intermediate stations without adding any additional transmission lines.

With Remote Set Index—

- Easy to set—set the index, push a button and the rest is automatic: a pulse whose duration is directly proportional to the value of the set point is transmitted to remotely located controllers.
- Can be used as part of a multiplexing system.

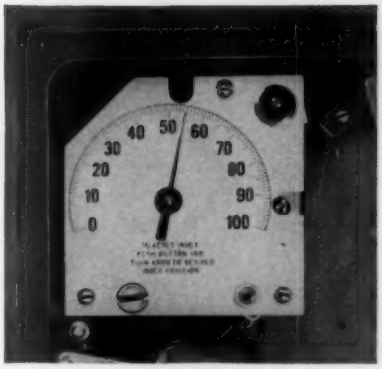
The *Dur-O-Pulse* system measures and transmits process variables such as pressure, temperature, flow, level, voltage, current, power and speed. It can send data quickly and accurately over all types of circuits.

set index setting simplify operation Dur-O-Pulse telemetering systems

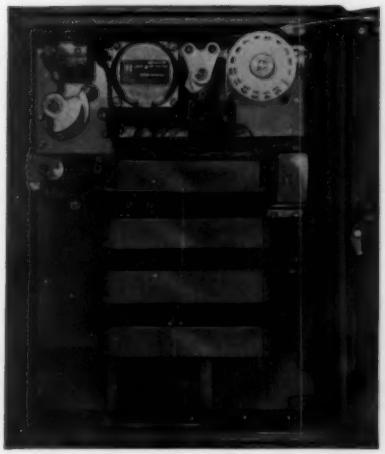
- Gives you set point indication at transmitting and receiving instruments.
- A single tone is required for the index signal when audio tone multiplexing is used.

Find out about *all* the performance and maintenance advantages of *Dur-O-Pulse* from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone.

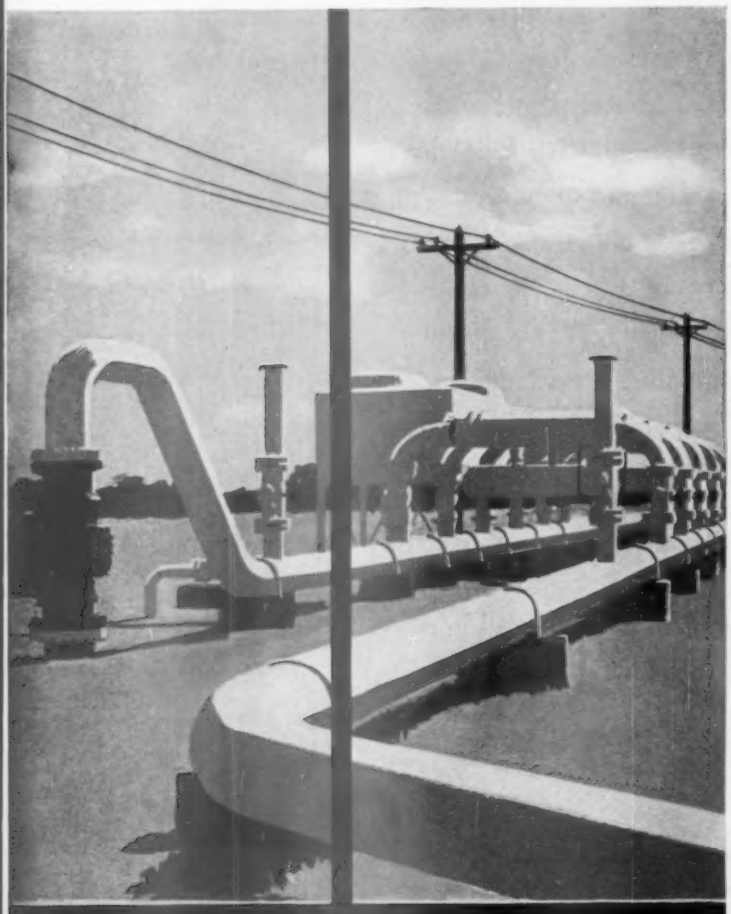
MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa. In Canada, Honeywell Controls, Ltd., Toronto 17, Ontario.



REMOTE-SET INDEX TRANSMITTER eliminates separate push buttons or switches needed to drive controller index up or down scale. To readjust controller index it is necessary only to adjust the indicating pointer to the desired set point and push the start button.



TIME MULTIPLEXING UNITS transmit up to 15 variables in one or both directions and provide a synchronizing signal to keep transmitting and receiving units in step.



75th YEAR
PIONEERING THE FUTURE

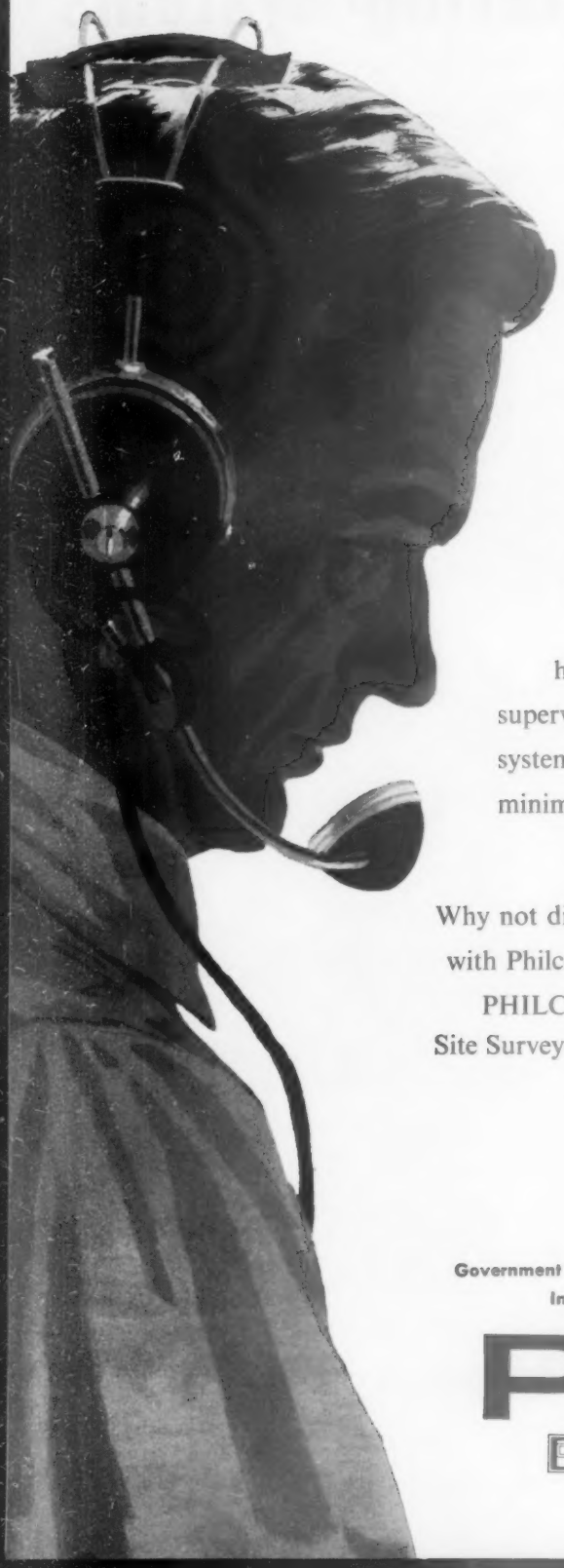
Honeywell

First in Control

SINCE 1885

PHILCO MICROWAVE SYSTEMS

...for dependable, flexible, economical pipeline communications



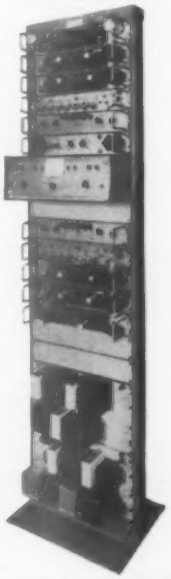
Custom designed to meet each specific requirement . . . and featuring the time-proved CLR-9 duplex terminal with wideband composite signal . . . Philco microwave systems provide highly reliable, unattended, point-to-point communications facilities for voice, telemetering, VHF maintenance and intersite voice . . . plus high-speed data transmission and supervisory control. Philco microwave systems are highly reliable, and assure minimum maintenance and significant economies in operating costs.

Why not discuss your specific requirements with Philco engineers? Inquire too, about:

PHILCO TURNKEY SERVICES

Site Survey • System Planning • Installation

Field Service



Philco CLR-9 Microwave Relay . . . with 240 voice channel capacity. Available in Common Carrier, Industrial and Government bands.

Government & Industrial Group, 4700 Wissahickon Avenue, Philadelphia 44, Pa.

In Canada: Philco Corporation of Canada Limited, Don Mills, Ontario

PHILCO®

Famous for Quality the World Over

From two horses to 200-horsepower

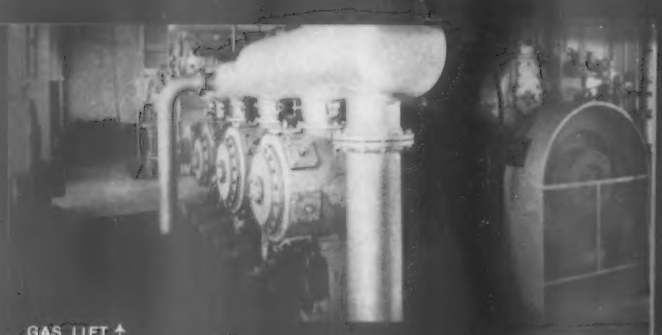
YESTERDAY—"petroleum" was primarily kerosine, the fuel that fed the lamps and cooking stoves of America. Sold by local grocery and hardware merchants, it was delivered to them once a week. It was Texaco that first met the urgent need for twice-weekly deliveries, with its horsedrawn tank wagons. Daily deliveries soon followed.

TODAY—the chief product of petroleum is gasoline, moved swiftly from storage point to market in giant, modern tank trucks. Today Texaco's fleet of red trucks serves more than 39,000 Texaco Dealer stations across the nation. Alert marketing operations, based on service to America's motorists, have contributed to Texaco's continued growth.

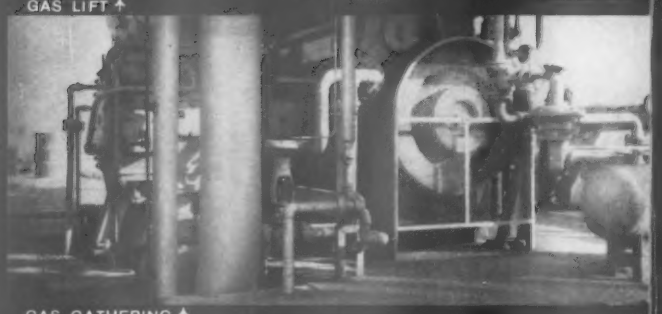
TEXACO

NO. OF UNITS

'55 '56 '57 '58 '59 '60

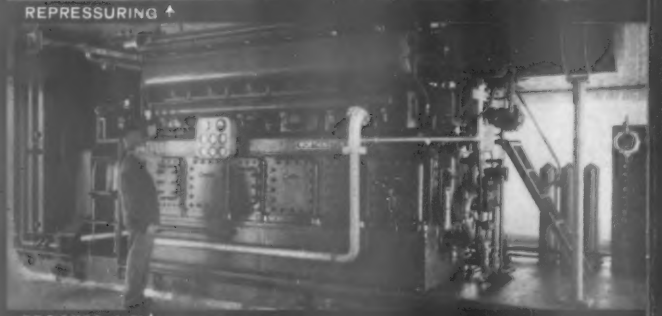


GAS LIFT

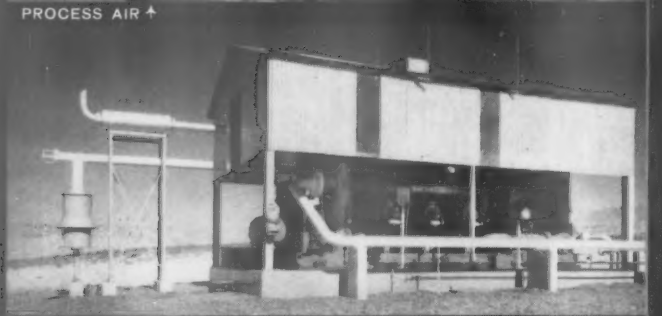


GAS GATHERING

REPRESSURING

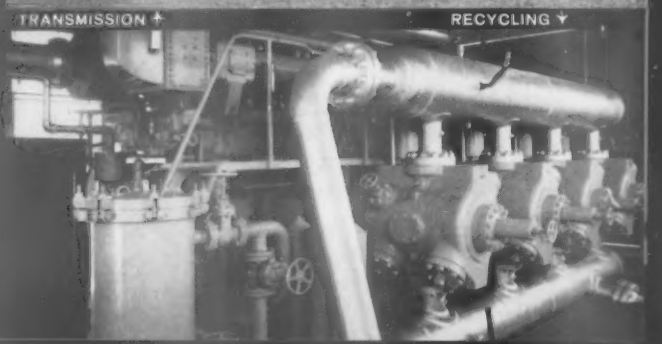


PROCESS AIR



TRANSMISSION

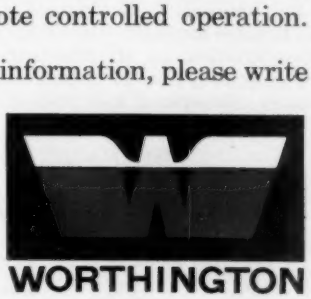
RECYCLING



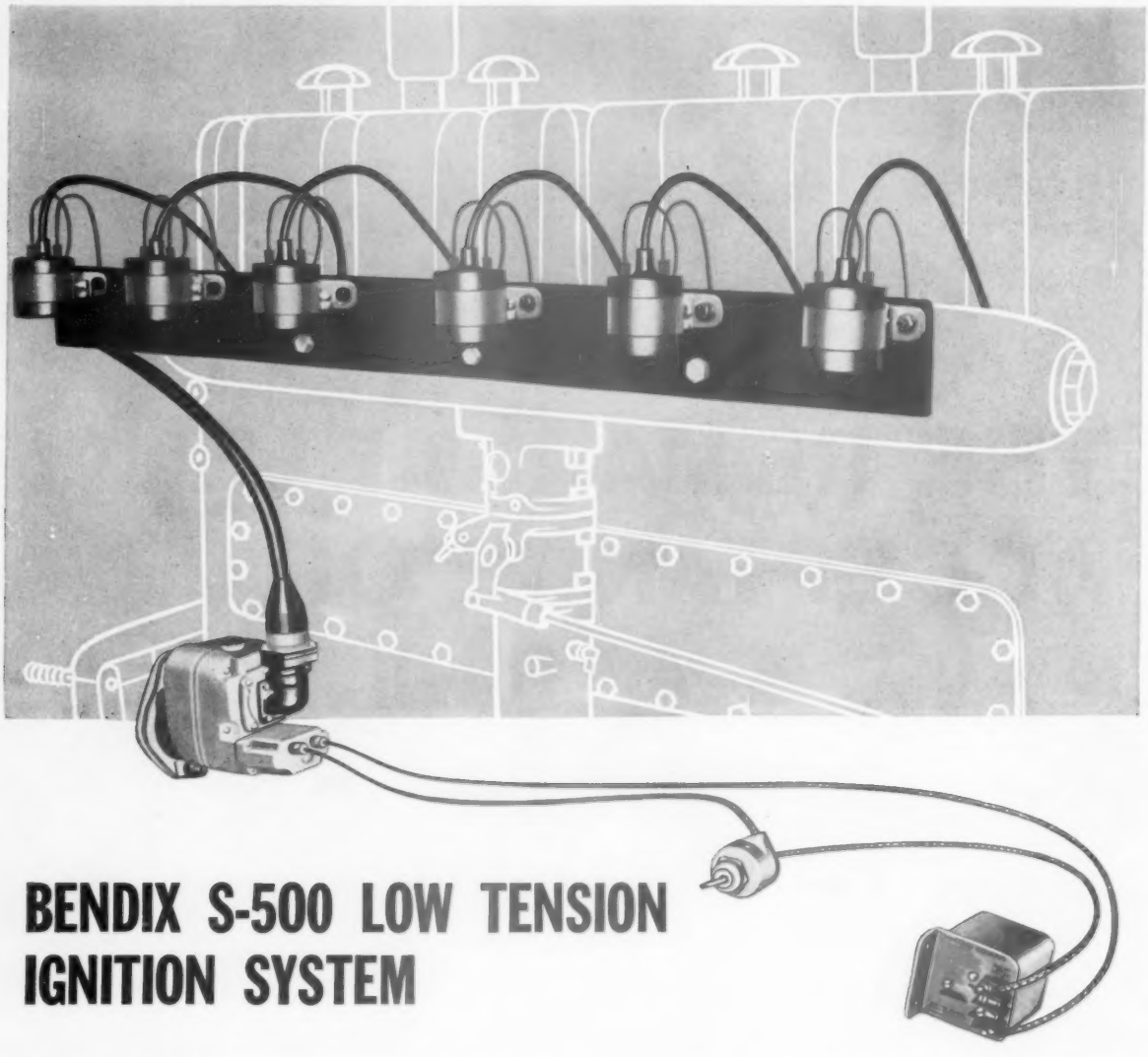
THE REMARKABLE ACCEPTANCE OF SLHC

The five year sales picture for Worthington's new SLHC gas engine-compressors is dramatic evidence of user acceptance. From their introduction, they've proved extremely reliable on all applications, ranging from gas gathering and gas transmission to repressuring and processing for the chemical and petroleum industries.

In addition to reliability, these turbocharged engines are 15 to 21 per cent more economical than competitive engine compressors. They have lower heat rejection, requiring minimum cooling facilities. And they're equipped for efficient performance over a wide range of loads and speeds in attendant or remote controlled operation. Foundation or skid mount. Horsepowers from 375 to 950. For information, please write Worthington Corporation, Dept. 43-14, Buffalo, N. Y.



The latest for small-to-medium industrial engines



BENDIX S-500 LOW TENSION IGNITION SYSTEM

The S-500 System provides the ultimate in starting and operating efficiency for your four, six, and eight cylinder industrial engines. Specify the new Bendix™ S-500 Low Tension Ignition System. It features "the modern starting concept"—retard breaker magneto and starting vibrator system.

This complete Low Tension Ignition System—including transformer coils, wiring cable assembly, starting vibrator, ignition and starting control switch, and retard breaker magneto—is custom-engineered to assure positive ignition at all cranking speeds and varied retard requirements. It is furnished in base or flange mounting, flameproof and radio shielded, is adaptable for manual or automatically controlled installations.

TRADEMARK

The S-500 Series, either base or flange mounted, is supplied with the following features:

S-500 Standard Shielding, adjustable drive assembly.
S-501 Standard Shielding, adjustable impulse coupling.
S-502 Super-shielded, adjustable drive assembly.
S-503 Super-shielded, adjustable impulse coupling.
S-504 Standard Shielding, retard breaker, adjustable drive.
S-505 Super-shielded, retard breaker, adjustable drive.

For additional information concerning the best Bendix Ignition System for your particular engine requirements, write:

Scintilla Division
SIDNEY, NEW YORK

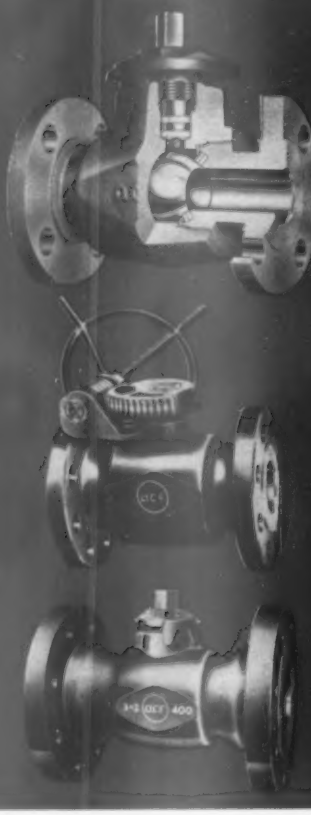
THE Bendix CORPORATION

Export Sales & Service: Bendix International, 205 E. 42nd St., New York 17, N. Y.

"Install 'em anywhere – no maintenance needed"

PRODUCT OF W-K-M's

Creative Engineering



ACF non-lubricated Ball Valves feature Teflon stem gaskets and seats. There's no lubricant to cause sticking or contamination.

Working Pressures: In carbon steel with ASA ratings of 150 pound and 300 pound, and some sizes in ASA 600 pound; in semi-steel with 200 and 400 pound WOG ratings.

Sizes: ½" through 6". Regular port valves up to 8" x 6".

5922

ACF non-lubricated Ball Valves

ACF Ball Valves are not only non-lubricated . . . but designed *throughout* for maintenance-free performance. For example: The ball is suspended between Teflon* seats under compression for leakproof sealing. Seats are protected from the lading flow. And the full bore conduit provides *smooth* flow, with no destructive turbulence . . . no more pressure drop than through an equal length of pipe.

A quick quarter-turn operates this rugged valve. Specify it. You'll get efficient, economical performance. *Available from leading suppliers everywhere.*

* Du Pont Trademark

WRITE FOR CATALOG 1000

W-K-M

DIVISION OF ACF INDUSTRIES
INCORPORATED
P. O. BOX 2117, HOUSTON, TEXAS

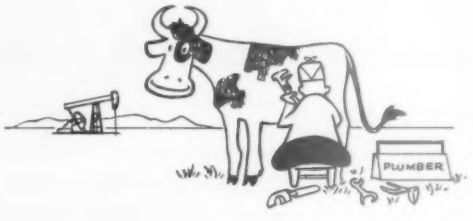
with the chain you gain...

WIDE-BASE UNIT PORTABILITY

With a Parkersburg chain-driven unit mounted on a wide base, you gain complete portability. This is especially important in remote locations, where installation of the usual concrete base is not practical.

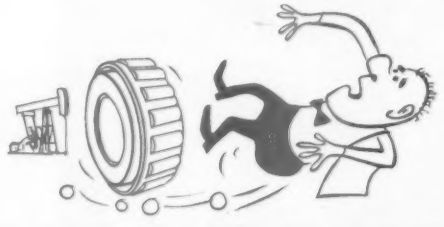
COLD-WEATHER OPERATING EFFICIENCY

Under extreme-weather operating conditions, Parkersburg chain-driven units have performed more efficiently than any competitive geared unit. Light oil used in lubrication makes this possible.



READY REPAIRS IN THE FIELD

Repairs to a geared reducer in the field are next to impossible. With a Parkersburg chain-driven unit, repairs in the field are routine. This is especially important in remote operating conditions.



COMPLETELY ROLLER-BEARING EQUIPPED

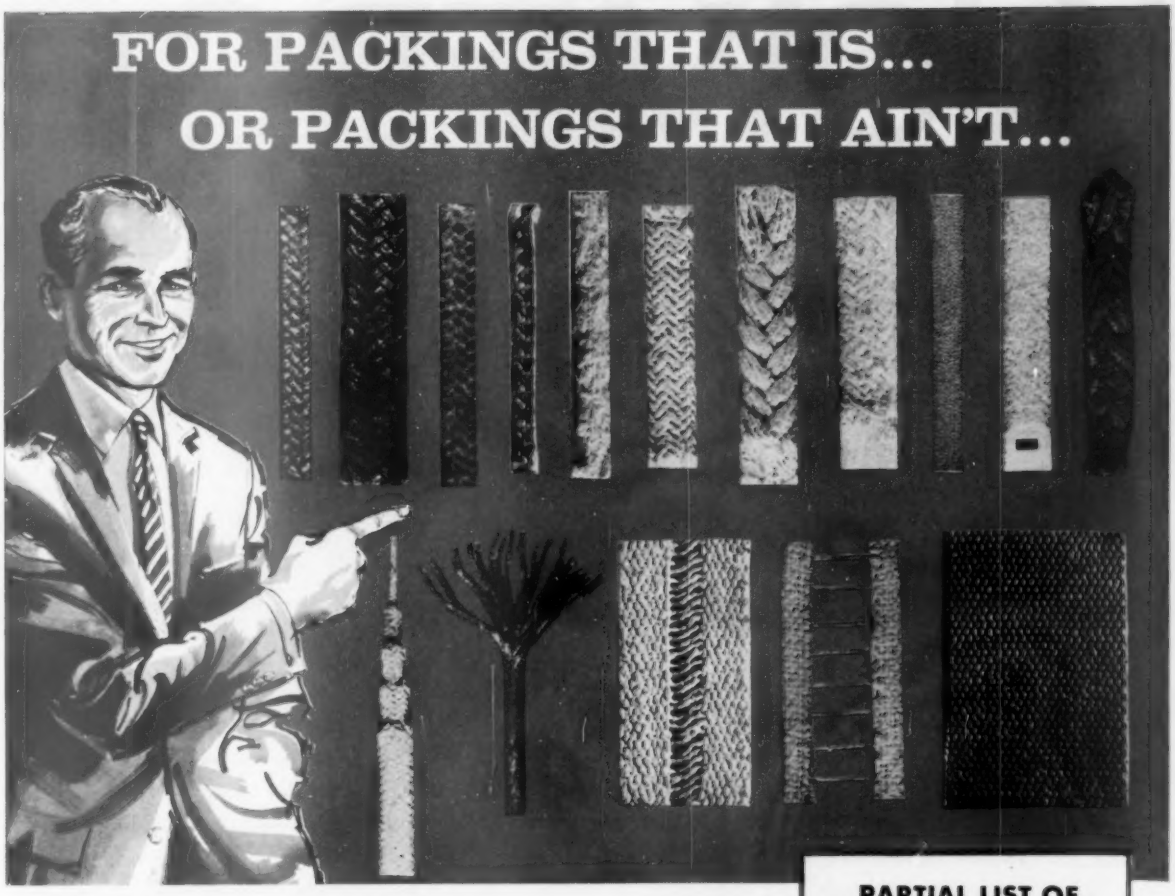
Where efficiency is important, the Parkersburg chain-driven unit has proved itself again and again. Completely roller-bearing equipped, the chain unit has longer life, higher resale value than any other pumping unit in the field.

Parkersburg Pumping Units Are Available Through the Following Supply Stores: American Pipe & Supply Co., Beacon Supply Co., Bovaird Supply Co., Canadian Equipment Sales & Service Co., Ltd. (Canada), Franklin Supply Co., Franklin Supply Co., Ltd. (Canada), Houston Oilfield Material Co., Inc., Industrial Supply Co., Iverson Supply Co., Mid-Continent Supply Co., Midland Supply Co., Inc., Mountain Iron & Supply Co., Oil Equipment, Ltd. (Canada), The Producers Supply & Tool Co., Republic Supply Co., Rodman Supply Co., Superior Iron Works & Supply Co., United Supply & Manufacturing Co., Wilson Supply Co.

THE PARKERSBURG RIG & REEL COMPANY
Division of Parkersburg-Aetna Corp.

PARKERSBURG • HOUSTON • COFFEYVILLE

FOR PACKINGS THAT IS...
OR PACKINGS THAT AIN'T...



UNARCO job-specified asbestos packing...
Most complete line from one supplier

Got a job that needs a special type packing? High pressure? Semi-high pressure? Valve stem packing? Gasket tape? Sheet packing? Joint runner? Braided tubing?

You name it. The chances are excellent we can furnish you with a top quality packing at competitive prices that "is"—right out of stock. But if you have a particularly tough problem that looks like it might take a "tailor made" packing that just "ain't," let us know. You can bet we'll start working on an answer in a hurry . . . and again you'll get the best, and at the right price.

Write today for complete information on Unarco Packings.

PARTIAL LIST OF PACKING AVAILABLE

- High-Pressure Asbestos Rod Packing
- Blue Asbestos Packing—acid resistant
- Square Braided Asbestos Packings
- Asbestos Gasket Cloth and Sheet Packings
- Asbestos Joint Runners
- Asbestos Double Seal Gasket
- Valve Stem Packings (twisted and braided)
- Asbestos High-Pressure Packing—semi-metallic
- Wrapped Asbestos Packing
- Compressed Asbestos Sheet
- Braided Asbestos Packing
- Interlocking Asbestos Packing
- Plaited Packing

INDUSTRIAL PACKINGS

the packings with "job-specified" design

UNARCO®

UNARCO PRODUCTS

• UNIBESTOS, Amosite Asbestos Pipe Covering and Block • Calcium Silicate Pipe Covering and Block • 85% Magnesia Pipe Covering and Block • Mineral Fiber Block • Wrap-On Insulation • Lace-On Insulation • Turbine Blankets • Insulating and Finishing Cements • Asbestos Textiles • Packing and Gasketing.

UNION ASBESTOS AND RUBBER COMPANY • FIBROUS PRODUCTS DIVISION

DEPT. 238, Bloomington, Illinois

KNOWLEDGE
STUDY
CREATIVE URGE
PROFESSIONAL DEDICATION

produce engineering achievement and accomplishment

Behind the design and manufacturing of Western Heat Exchangers lies the "creative urge" which invariably precedes productive accomplishment in any field of engineering. It is the initiative and creativity of Western's engineering personnel, combined with continuing research into the depths of thermal, mechanical and metallurgical design, that are largely responsible for the universal acceptance of Western heat transfer equipment throughout industry.

Western's engineers await your invitation to collaborate with your own engineers, toward the solution of your next heat transfer problem, however intricate.

WESTERN'S STAKE IN YOUR FUTURE

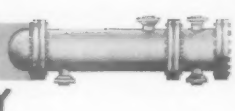
Your engineers, like ours, must *grow* in their profession, and to encourage their future development, Western is currently publishing a series of messages, as shown at right, in major trade journals. A more complete treatment of each subject is available in pamphlet form, either singly or in quantities, merely upon request. Write today.

One of a series appearing in OIL & GAS JOURNAL, CHEMICAL ENGINEERING, PETROLEUM REFINER, REFINING ENGINEER, CHEMICAL ENGINEERING PROGRESS.

serving the growth of the process industry

WESTERN

HEAT EXCHANGERS



WESTERN SUPPLY COMPANY

P. O. Box 1888 – Tulsa, Oklahoma

Personal, professional advancement demands thorough engineering knowledge, disciplined habits, creative thinking, constant application

"Intellectual let-down" — that tendency so common to many engineers to "stop learning" as soon as they acquire a sheepskin — will be completely out of style by 1999. Indeed, it is passe in today's accelerated engineering profession, because to stop learning is to stop growing;

HEAVIER OUTSIDE WIRES mean great resistance to abrasion. FINER INSIDE WIRES mean excellent drum winding characteristics.

In REGULAR LAY ropes the wires are laid in a direction opposite to the lay of the strands. This provides stability even under severe operating conditions.

In LANG LAY ropes the wires and strands are laid in the same direction, providing exceptional flexibility and abrasion resistance.

Two ropes in one! Roebling Herringbone® Wire Rope is designed and made to wear better, work better, last longer than you can possibly imagine . . . unless you've tried it yourself!

Herringbone combines two pairs of Lang Lay strands with one pair of regular lay strands to give you maximum flexibility, good stability, mighty strength. Call your Roebling Distributor — or write for details to Roebling's Wire Rope Division, Trenton 2, N. J.

HERRINGBONE WIRE ROPE

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation

CLARK Centrifugal Compressors Assure 100% Availability

Typical Clark Isotemp Compressor installation with synchronous motor drive and gear located on mezzanine level.

NO STANDBYS ARE NEEDED IN YOUR AIR SEPARATION PLANT

In air separation plants throughout the world, Clark Horizontally-Split Centrifugal Oxygen Compressors are operating in 100% service. Because the Type HS Compressors are literally maintenance free, standby units have not been required. The performance of these machines has been outstanding with safety, dependability and efficiency being among the features "best liked" by operators.

Now, another centrifugal compressor has been added to the Clark line of air separation compressors. The new Clark Isotemp Centrifugal Air Compressor has been designed to provide highest purity, primary 110 psi. air for tonnage oxygen plants. Like the Type HS Oxygen Compressors, the *Isotemp* is designed for 100% availability. It incorporates many of the design features found to be so effective in the oxygen machines.

A key feature of the Clark Isotemp Compressor is the system of integral intercoolers. Built into the base of machine, they form a compact unit-engineered package. An unusually high efficiency over a wide operating range is produced by intercooling between stages, the use of closed-type impellers and volute diffusers. Single-case, horizontally-split design assures maximum accessibility and eliminates alignment problems.

If you need high purity compressed air in large volumes, the Clark *Isotemp* will provide substantial savings in capital investment, space, foundation requirements, maintenance and operating costs. The *Isotemp* is built in seven frame sizes in packages with capacities ranging from 5000 to 50,000 cfm and more. Clark Oxygen Compressors are available in matching frame sizes. Both the Isotemp and Type HS units can be driven by synchronous motors, induction motors or turbines.

For data on Clark Centrifugal Compressors and Reciprocating Compressors consult your nearest Clark representative or write for Bulletin 175 on Isotemp Compressors, Bulletin 150 on Centrifugal Oxygen Compressors or Bulletin 160 on Clark Reciprocating Process Compressors.

CLARK BROS. CO.
OLEAN, N.Y.

ENGINES
COMPRESSORS
GAS TURBINES

CLARK
ENGINES
COMPRESSORS • GAS TURBINES

DRESSER INDUSTRIES INC.
OIL • GAS • CHEMICAL
ELECTRONIC • INDUSTRIAL

YOU CAN COUNT ON FABRICATION TO

YOUR SPECIFICATION

WITH PETROCHEMICAL PROCESSING EQUIPMENT

AT NEWPORT NEWS

This reactor cap is made of molybdenum plate. Top courses are 1 13/16" thick and the lower courses are 1 9/16" thick.

Newport News is famous for the painstaking care that goes into every step of the fabrication of heavy process equipment for the petrochemical industry.

A separate, fully equipped shop specializes in the production of all types of pressure vessels and process equipment. Rolls, ovens and other machinery can handle plates up to 5 inches thick. Qualified staffs of engineers and technicians backed up by hundreds of skilled workmen use the most advanced techniques to produce vessels to all specifications. The 225-acre Newport News plant also contains a foundry capable of producing individual castings up to 100,000 pounds, forge facilities that can process units weighing as much as 48,000 pounds and machine shops equipped to mill pieces up to 42 feet in diameter.

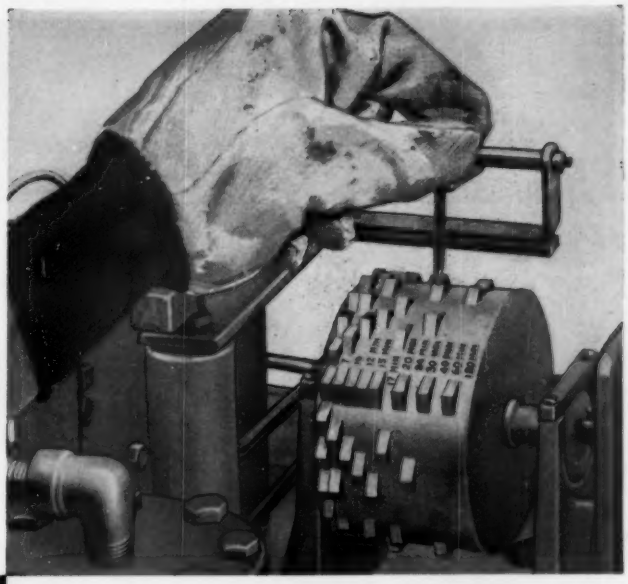
Use the men, the methods and the machines of Newport News for your next project. Learn how Newport News can produce your needs . . . on time and to specification. Write today!

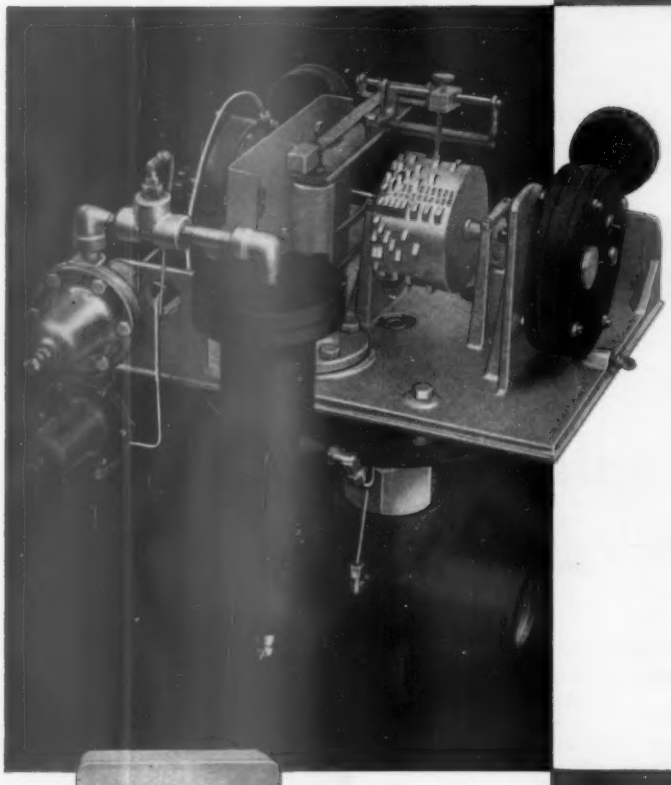
Newport News
SHIPBUILDING AND DRY DOCK CO.
NEWPORT NEWS, VIRGINIA

Accurate Gas Lift
Time Cycle Control With
Finger-Tip Adjustments

GUIBERSON'S AF

Intermitter-Regulator





Here's a real *oil field tool.* A rugged, long lasting intermitter-regulator for gas lift, which can be accurately set by a field man *with his gloves on*.. no special tools needed.

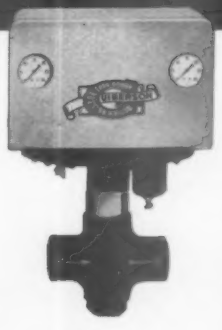
Note the intermitter-regulator with the cover removed. See how simple and trouble free the mechanism is.. no loose pins to set.. no tiny parts to adjust.

Select a time cycle by moving the adjusting screw along the slide bar until it lines up with the desired time embossed on the drum. Then set the injection time by turning the adjusting screw. Turning right increases.. left decreases.

Cycle frequencies are possible from an every five minute maximum to a minimum of one injection per revolution of the two-hour clock. Each cycle repeats with reliable accuracy.

For use as a pressure regulator, back off the adjusting screw until it clears timer drum tabs. Set to hold desired pressure with adjusting knob on the bourdon tube. It's as simple as that.

All parts are corrosion resistant and precision-made for long life and dependable service.



Ask your Guiberson representative about the multiple control problems you can solve with Guiberson equipment.

SAFER THAN SORRY — BETTER BE — GUIBERSON

THE

GUIBERSON

CORPORATION

ESTABLISHED 1919

DALLAS, TEXAS U. S. A.

Engineering Progress Report

FROM UNION CARBIDE CHEMICALS COMPANY

Ethylene Glycol Scores High As Hydrate Inhibitor

In refrigeration-type gasoline recovery plants, the most widely used hydrate point depressant is diethylene glycol. But, ethylene glycol may offer certain advantages as a replacement in your plant, for example . . .

SELECTION GUIDE

ADVANTAGE	Ethylene Glycol	Diethylene Glycol
Hydrate Inhibition	GOOD	GOOD
Ease of Separation	BETTER	GOOD
Cost	LOWER	—
Vaporization Loss	LOW	LOWER
Solubility Loss	LOWER	LOW

HYDRATE INHIBITION

While both ethylene and diethylene glycol give good hydrate inhibition, with hydrate point depressions generally in the range of 60° to 80°F., reports indicate that ethylene glycol may give a greater depression in those cases needing very low separation temperatures.

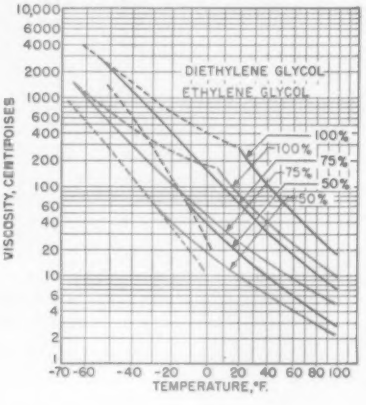
EASE OF SEPARATION

Ethylene glycol-water solutions are easier to separate at very low temperatures than diethylene glycol-water solutions.

This advantage is illustrated in the graph below. At 0°F. the viscosity of a 50 per cent ethylene glycol solution is 20 centipoises, or half the viscosity of the diethylene glycol solution.

An even more marked difference is shown at lower temperatures . . . at—40°C. a 75 per cent ethylene glycol solution has a 300 centipoises viscosity, as compared with 1000 to 2000 for a 75 per cent diethylene glycol solution.

VISCOSITY OF GLYCOL-WATER MIXTURES



COST

Ethylene glycol costs 1¾¢ a pound less than diethylene glycol which means a possible tank car savings of $1,300.

VAPORIZATION

Although ethylene glycol vaporization losses are greater than diethylene glycol's, the difference is insignificant below 30°F., if separator pressure is 750 PSI or higher.

SOLUBILITY

At separation temperatures of 60°F., glycol losses due to solubility should be in the range of 10 to 50 ppm when 50 to 75 per cent ethylene glycol solutions are used; and 20 to 100 ppm with equal strength diethylene glycol.

The higher volatility of ethylene glycol must be taken into consideration in regeneration equipment design and operation; but ethylene glycol may offer advantages in certain systems. Your CARBIDE Technical Representative can show you data on the pros and cons of ethylene or diethylene glycol hydrate inhibition in your system.

For a copy of a new report, "The Glycols as Hydrate Point Depressants in Natural Gas Systems" and a comprehensive bibliography of all the major articles published on gas sweetening and dehydration in the last 25 years, use the coupon.

UNION CARBIDE is a registered trade mark of Union Carbide Corporation.

UNION CARBIDE CHEMICALS COMPANY, Division of Union Carbide Corp., 270 Park Ave., N. Y. 17, N. Y.

Please Send Me

- ☐ Technical data report—"The Glycols as Hydrate Point Depressants in Natural Gas Systems."
- ☐ 24-page Gas Sweetening Bibliography.
- ☐ Please have a CARBIDE Technical Representative call.

NAME:..... POSITION:.....

COMPANY:.....

ADDRESS:.....

CITY:..... STATE:.....

UNION CARBIDE CHEMICALS COMPANY

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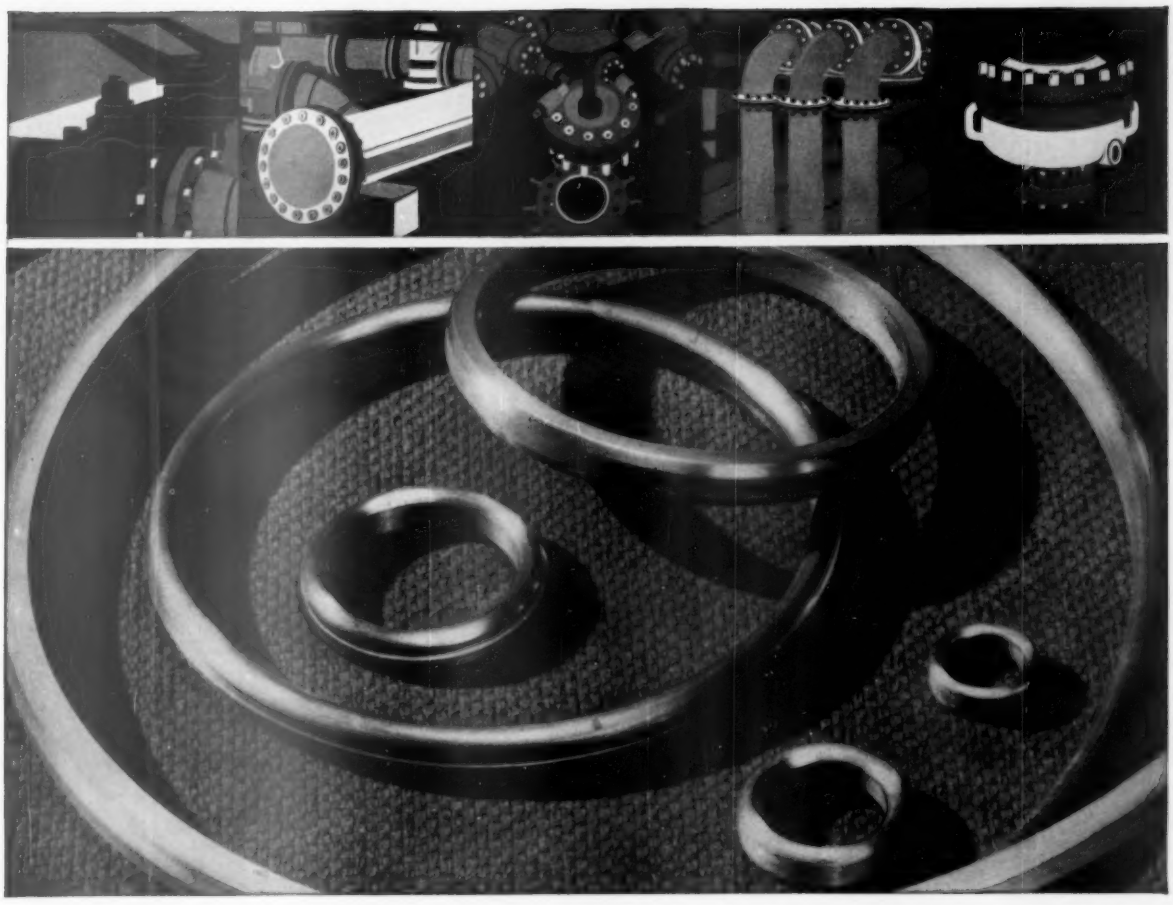


Get safer, surer sealing in ring-grooved joints with J-M V-TITE® GASKETS

YOU WILL BENEFIT BY CHOOSING THE GASKET PROVED IN SO MANY APPLICATIONS!

If you are concerned with the design or maintenance of ring-type joints, it will pay you to insist on the tighter, more efficient and longer-lasting seal you get with J-M's V-Tite design. Many equipment builders install these outstanding gaskets, and if it's your job to keep this equipment operating at top efficiency, here's a good point to remember: the gaskets that are right to *start* with . . . are right to *stay* with.

V-Tite Gaskets are "right" because every step in their manufacture is meticulously performed. Close tolerances are rigidly maintained for matching of rings with flange grooves. Carefully-controlled annealing keeps gasket hardness well below flange hardness . . . to assure proper flow and sealing without damaging the flange surfaces. Contact surfaces are smoothly finished . . . with no ridges, no tool or chatter marks that cause joint leakage.

J-M produces a wide selection of custom-designed and standard gaskets in any material, dimension or cross-section you require . . . including the new pressure-actuated BX Ring Gasket for extreme pressure service up to 15,000 psi at temperatures up to 250 F.

Complete information from your J-M Distributor. Or write to Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario.

JOHNS-MANVILLE

V-Tite Gaskets meet API specifications

Superior quality 12¾" O.D. J&L Electricweld line pipe was used for 17 miles of this Northern Oklahoma Gas Company line from Cherokee to Ponca City. The line will serve the towns of Ponca City, Perry and Newkirk, Oklahoma, and area industries. J&L line pipe is available in sizes from 6⅝" to 12¾".

General Contractor:
O. R. Burden Construction Corporation, Tulsa, Oklahoma
Contractor for coating and wrapping:
Secrest Pipe Coating Service, Tulsa, Oklahoma

Pipe laying operations with this J&L Electricweld line pipe are fast and efficient. Weldability is excellent. Pipe is 29.28 pounds per foot, .219" wall, X-46 grade.

Reliable field performance is assured because every length of J&L pipe undergoes a specified hydrostatic pressure test which proves its dependability under sustained and surge pressures.

This ultrasonic tester provides immediate pictures of weld soundness in all J&L Electricweld line pipe. It is one of the most advanced control devices in pipe-making.

Quality control at J&L pays off on a job at Cherokee

Every length of J&L line pipe passes over 50 quality tests before it enters the field

Total quality control of J&L Electricweld line pipe is maintained through more than 50 control measures and tests on every length of pipe.

Crush tests assure weld strength and steel quality. A modern ultrasonic device probes soundness of the weld. All joint ends are magnafluxed to assure freedom from flaws. Every length is full-pressure tested under specified A.P.I. or A.S.T.M. hydrostatic test requirements, both in time and degree of pressure. These are a few of the stringent controls that assure complete dependability of J&L Electricweld line pipe.

It pays to specify plant-tested, field-proved J&L Electricweld pipe for your transmission, distribution or gathering lines. Write for J&L's new bulletin.

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA

"Petrochemicals? You Bet!"

First City National Bank was among the first banks to recognize the almost unlimited future of the petrochemical industry. Financing all phases of its operations has become an important function of the Bank's Oil and Gas Department. If petrochemicals are in your planning, talk over your plans with men who *know* the business – the men of the First City National Oil Department. Come in to see us.

SOON! First City National will be serving you in the newest, best equipped, most modern banking quarters in Texas.

FIRST CITY
NATIONAL BANK OF HOUSTON

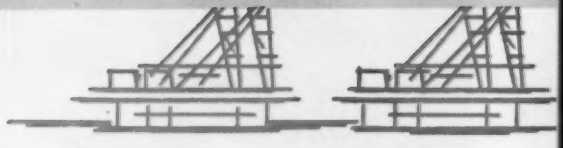
MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

ATLAS EMULSIFIER saves $15,125 in 5000′ comparison

Carper Drilling Company of Artesia, New Mexico, is typical of contractors and operators that have been able to effect substantial savings in drilling costs by using an Atlas emulsifier. Here is a direct comparison of the drilling records of Carper's State MA-A #1, located in Lea County, New Mexico, Section 31, 17S, 33E, and an offset well in Eddy County, Section 29, 17S, 31E. Both wells were drilled about the same time through the same formation to a total depth of 10,000 feet. The rig used on the Carper well was smaller, having lower power, hoisting, and hydraulic capacity. The comparison well, using a low-solids CMC mud, required over twice as many bits at an additional cost of $7,425; difference in rig time accounted for another $7,700 . . . a total of $15,125 in tangible savings.

DRILLING RECORD COMPARISON

	STATE MA-A #1	OFFSET WELL
Mud	Atlosol emulsion	low-solids CMC
Interval	5,123′-10,015′	5,263′-10,011′
Feet Drilled	4,892	4,748
Rig Hours	857	997
Feet per hour	5.7	4.8
Bits	27	60
Feet per bit	181	79
Weight on Bit	30,000-45,000#	60,000-65,000#
Drill Pipe	3½″	4½″
Drill Collars	17—6″ x 2¼″	20—7″ x 2¾″
Pumps	1—18″ 1—14″	2—20″
Liner Size	5½″	6½″



Atlas emulsifier is sold through distributors under these tradenames . . . each is the product of Aquaness Department, Atlas Powder Company:

TRIMULSO®

Distributed by Baroid Division, National Lead Company

Registered trademark Baroid Division, National Lead Company

DRILLING MILK

Distributed by Magnet Cove Barium Corporation

Registered trademark Magnet Cove Barium Corporation

ATLOSOL

Distributed by Milwhite Mud Sales Company and other selected mud companies

Registered trademark Atlas Powder Company

Atlas Emulsifiers Improve a Good Drilling Fluid.

Better Hole Conditions. Torque is decreased as much as 50% . . . the hole is kept cleaner and pump pressures are correspondingly lower. There is less danger in loss-circulation and low-pressure zones.

Longer Bit Life. Prevents balling, provides better cutter and bearing lubrication. Greatly extended bit life reduces bit costs, reduces rig hours lost to trip time.

Faster Drilling Rates. More feet of hole per hour. Oil lubrication combines with improved hole condition to increase drilling rates in competent and troublesome formations.

ATLAS Aquaness CHEMICALS ATLAS POWDER COMPANY

Aquaness Department, Atlas Powder Company

P. O. Box 21072 • Houston 26, Texas

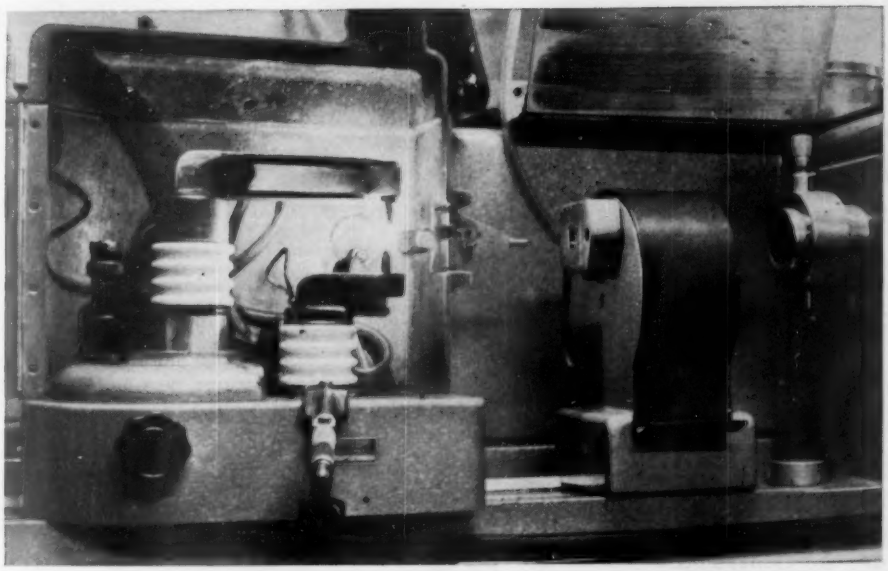
AQ 116

10,125 tests a day assure consistent quality in

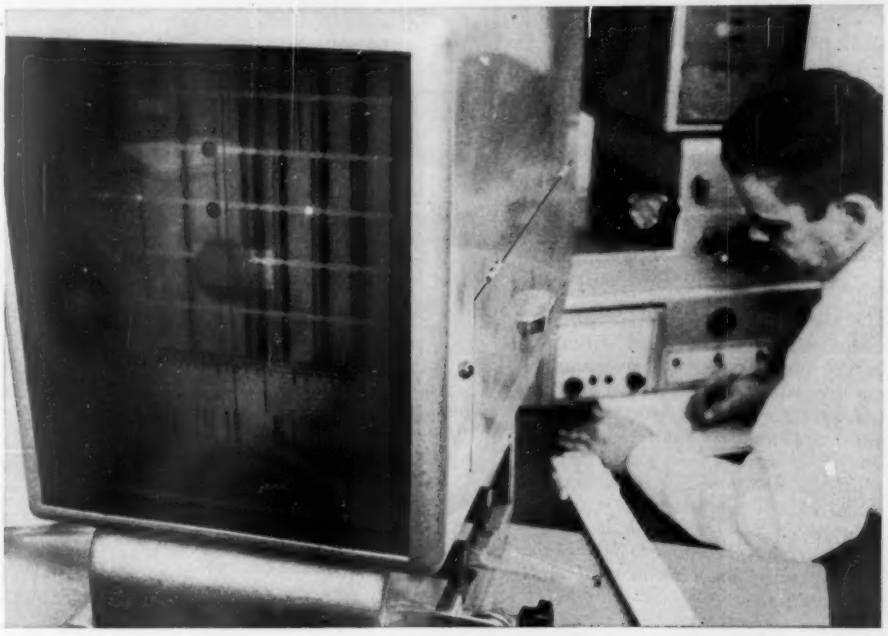
GULF MAKES THINGS

These bottles contain samples of a variety of Gulf fuels and lubricants. Each has been subjected to a series of quality control tests at Gulf laboratories. Any one of the tags shown might carry the "pedigree" of a Gulf product for a drilling rig or a pipeline pumping station.

Product purity is policed constantly at Gulf. During the refining process, samples from *every* lot of Gulf gasoline, diesel fuel, lubricating oil and grease are tested and re-tested to make sure that formulations are exact and that impurities are essentially eliminated. For ex-



Emission Spectrograph (above) causes undesirable elements in a petroleum sample to emit their characteristic light spectrum which is photographed on a strip of film. In the Densitometer (below) the spectrum on the film is evaluated to identify the presence of metal contaminants down to less than one part per million.



every Gulf® product . . .

RUN BETTER!

ample, Gulfcrest® 44, world's leading turbine oil, is quality-controlled to limit contamination to less than one part per million.

A continuing program of quality control tests is one of the reasons we say: Gulf Makes Things Run Better!

GULF OIL CORPORATION
Department DM, Gulf Building
Pittsburgh 30, Pennsylvania

GULF®

They Say—

Mobil keeps single brand

Dear Sir:

Many of us at Mobil Oil Co. read your excellent article, "Humble Gets a Foot in California's Door," in the June 27 issue (p. 80). I am puzzled, however, by these two sentences: "Marketing under more than one brand name is nothing new in California. All the majors do it except Texaco and Shell."

Mobil should have been one of the exceptions. Even before General Petroleum Corp., our West Coast affiliate, was merged into Mobil Oil on Dec. 31, 1959, our products were sold in California only under the "Mobil" brand name.

V. A. Bellman
Vice President, Marketing
Mobil Oil Co.

What about Sui?

Dear Sir:

I refer to your February 8, 1960, "Natural Gas Is Following Oil Across the Seas" (p. 155). Sui gas field has not been mentioned in this article. This reservoir was discovered in 1952. The total recoverable natural gas in this field is estimated to be about six million million cubic feet, ranking as the sixth largest gas field in the world.

I. Khawaja
Sui Gas Field
West Pakistan.

Editor's note: With an estimated productive area of 75 sq. miles, average porosity 18%, permeability 35 md. (average), and a 740-ft. pay column, Sui certainly must be rated as one of the world's great gas fields. The article in question did not attempt a world-wide inventory, but rather to point to a few recent finds in the Eastern Hemisphere and to deplore the lack of such discoveries in the U.S.A. in recent times.

Alaskan wildcat pegged

Dear Sir:

Please refer to the article "New Tests Scheduled for the Kenai Peninsula" in the June 20 issue of The Oil and Gas Journal (p. 94).

The location given in the text for the Halbouty Alaska Oil Co. well was Section 21-6n-9w, which is correct. However, the location on the accompanying map places the well in Section 21-7n-10w. The well is actually located approximately 9½ miles

the OIL AND GAS JOURNAL

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* Mission pump parts work together

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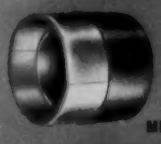

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*SMOOTHLY . . .

From watches to locomotives, mechanical parts work better together when they're designed and built to work together. The same is true for mud pump parts. With the Mission Guarantee you know that individually each part—liners, pistons, rods, valves and seats, packing, and springs—will outperform any others. But, when you put them together, allow them to do their best, the savings you get are even greater. And the other side of savings is your profit.

When you put Mission pump parts to work you know you're using the best, that's **guaranteed**; but you also are helping yourself the most, cutting your own costs. Start now to stop the waste of shopping around and standardize on Mission all the way.

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55—800

On the Job with Bethlehem Line Pipe

IN VENEZUELA—Forty-inch line pipe—some 12 miles of it—now lies as deep as 100 feet under the surface of Lake Maracaibo, helping to supply gas to one of Creole Petroleum Corporation's re-injection systems. The pipe was made by Bethlehem and supplied to the contractor, Brown & Root, Inc., in 40-ft lengths, each of which, when weighted with a 6-in. coat of mesh-reinforced concrete, tipped the scales at nearly twenty tons.

Steel

For strength
... economy
... versatility

	ELECTRIC FUSION-WELD	ELECTRIC RESISTANCE-WELD	CONTINUOUS BUTTWELD
SIZES (in., OD, incl.)	18 to 42	5⅝ to 16	½ to 4½
WALL THICK-NESS (in.)	¼ to ¾ incl.	API	API
LENGTHS	40 ft★	to 60 ft	SRL 24 to 26 ft DRL to 50 ft
SPECIFI-CATIONS	API 5LX, Grades X42, X46 & X52 Also X-56	API 5L, Grades A & B API 5LX, Grades X42 & X46	API 5L

★Made with 40-ft plates; submerged-arc-welded; hydraulically, expanded.

Bethlehem's new pipe mills at Steelton, Pa., and at Sparrows Point, Md., are turning out more pipe than ever before. And it's pipe of consistent top-quality, too—every length straight and true to round and bevel, and right up to specs.

It's easy to check all the facts about Bethlehem Line Pipe—just call the Bethlehem sales office nearest you.

IN PENNSYLVANIA—New gas service was brought into Carbon County recently when the Pennsylvania Gas Management Co. ran an 8-in. line to Lehighton from Transco's 24-in. main line at Saylorsburg. In spite of the winter and the rough terrain, McKenzie Construction Co., Inc. had no trouble laying the Bethlehem electric resistance-weld pipe. As supplied by C. J. Rainear & Company, Inc., the pipe measured up to specs in every way.

IN ARKANSAS—The latest addition to Arkansas-Louisiana Gas Company's extensive pipeline system is a 100-mile, 16-in. OD transmission line running across the summit of Magazine Mountain, the highest peak in Arkansas. The Bethlehem pipe in this line was furnished in .250-in. wall to API 5LX, Grade X-46 specification, and is now carrying pressures up to 1000 psi.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

WECO AIR-O-UNIONS

Perfect for low pressure lines

WECO Air-O-Unions have everything you want in quick, easy make-up, perfect sealing unions for low pressure lines, such as mud suction and return lines; for connecting mud tanks and other services where fluid pressures are low.

No bolts, nuts or wrenches are required. No close line-ups are necessary. Just a shot of air seals the inflatable tube . . . deflating it releases the seal for break-out.

With WECO Air-O-Unions permanently welded in place on your mud tanks, suction and return lines and fittings, mud systems are set up with less time, trouble and cost than ever before. Switch to low cost, time-saving, simple Air-O-Unions on all of your low pressure lines. They are available in sizes 6" through 16".

Your Supply Store has WECO Air-O-Unions . . . or ask your WECO or Chiksan representative.

WECO

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION

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AO-3-59

due south of Socal's Soldotna Creek wells.

Donald D. Bruce
State Petroleum Geologist
Anchorage.

FPC's too nosy for Canada

"It is surely unthinkable that the United States Federal Power Commission should control companies operating in Canada and, in fact, set the prices at which they sell their natural gas. But it is trying.

"What the Federal Power Commission is doing is asking that U.S.-based companies file annual reports with the U. S. body showing that profits of the Canadian companies are not greater than average profits of utilities operating in western Canada.

"Premier E. C. Manning is quite right in making a protest about an action seemingly designed to give that control to the U. S. body.

"The Federal Power Commission has every right the U. S. government wants to give it to regulate prices and supplies in the United States. It has no right to place conditions on Canadian companies or to demand reports about them. No matter how it is meant to protect U. S. consumers it can only mean tampering with Canada.

"If the Federal Power Commission feels it can force Canada to give up its control over its own companies then it should be advised that it cannot."

Editorial in the Calgary Herald.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

JULY

18-29 Massachusetts Institute of Technology, dynamics and control of chemical engineering processes program, Cambridge, Mass.

28-30 American Petroleum Institute, Division of Production, Eastern district meeting, The Greenbrier, White Sulphur, Springs, W. Va.

29 Southern Gas Association, transmission section roundtable conference on use of electronic computers by engineering personnel, and employe relations section accident prevention roundtable conference, Baker Hotel, Dallas.

AUGUST

3-5 Wyoming Geological Association, field trip to Snyder basin and Wind River Mountains, Casper.

14-19 National Congress of Petroleum Retailers, Inc., annual session, Shamrock-Hilton Hotel, Houston.

15-16 North Dakota Oil and Gas Association, annual meeting, Grand Pacific Hotel, Bismarck.

15-17 American Society of Mechanical Engineers, American Institute of Chem-

ical Engineers, heat transfer conference and exhibit, Statler Hilton Hotel, Buffalo, N. Y.

15-26 Sacramento State College, summer institute on nondestructive testing, Sacramento, Calif.

22-26 Gordon Research Conference, catalysis, Colby Junior College, New London, N. H.

29-31 Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, W. Va.

30-Sept. 2 American Association for the Advancement of Science, Alaska Division, eleventh Alaskan science conference, Anchorage.

SEPTEMBER

6-7 Chemical Institute of Canada, organic chemistry division conference, Edmonton.

7-9 American Society of Mechanical Engineers, joint automatic control conference, Massachusetts Institute of Technology, Cambridge, Mass.

7-10 Billings Geological Society, annual field trip, Hebgen Lake-Madison Valley area of southwestern Montana.

8-9 National Research Council, Chemical Institute of Canada, tenth Canadian high polymer forum, Alpine Inn, Montreal.

8-9 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

8-10 Chemical Institute of Canada, western regional conference, Regina.

8-10 Intermountain Association of Petroleum Geologists and Eastern Nevada Geological Society, field trip, economic geology of east-central Nevada.

11-16 American Chemical Society, national meeting, New York City.

14-15 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

14-16 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

15 Natural Gasoline Association of America, Rocky Mountain regional meeting, Palliser Hotel, Calgary.

15-16 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual engineering management conference, Morrison Hotel, Chicago.

16-17 Kansas Geological Society, twenty-fifth annual field conference, northeastern Oklahoma, Western Hills Lodge, Wagoner, Okla.

18-21 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Jung Hotel, New Orleans.

19-21 Texas Mid-Continent Oil and Gas Association, annual meeting, Hilton Hotel, San Antonio, Tex.

21-23 Pacific Coast Gas Association, annual meeting, Westward Ho Hotel, Phoenix.

25-27 American Association of Oilwell Drilling Contractors, annual meeting, Roosevelt Hotel, New Orleans.

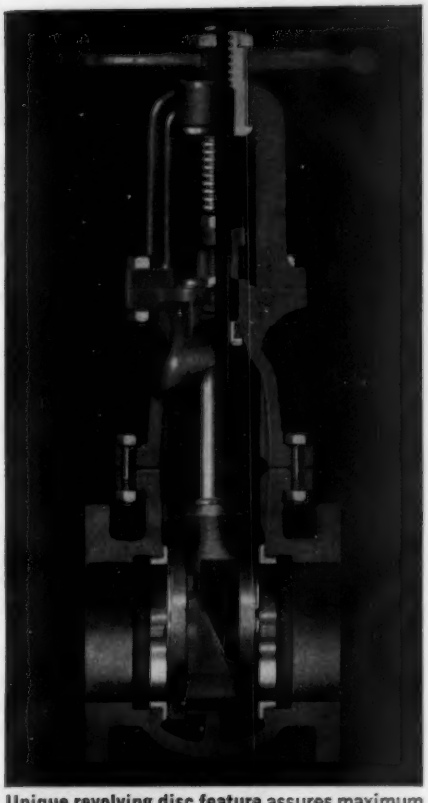
25-28 American Institute of Chemical Engineers, meeting, Mayo Hotel, Tulsa.

25-28 American Institute of Electrical Engineers, petroleum industry committee, electrical conference of the petroleum industry, Hotel Skirvin, Oklahoma City.

26-29 American Welding Society, fall meeting, Penn-Sheraton Hotel, Pittsburgh.

26-30 Instrument Society of America, instrument-automation conference and exhibit, and fifteenth annual meeting, Coliseum, New York.

For severe corrosive conditions specify ALUMINUM GATE VALVES by Darling



Unique revolving disc feature assures maximum life under the most exacting service conditions. Friction between wedges is reduced to a minimum. Horizontal and vertical equalization of wedging pressure is assured.

Handling corrosive chemicals such as hydrogen peroxide, ammonium nitrate, acetic acid, concentrated nitric acid? Darling Aluminum Gate Valves give you longer life, cut maintenance costs, under these and other severe service conditions. Here's why:

Darling metallurgical engineers have thoroughly tested and standardized on the most highly corrosion-resistant aluminum alloys in use today.

Accurate casting control and precision assembly reduces friction and wear, provides maximum ease of operation.

Darling Double Disc Parallel Seat principle assures freedom from leakage, trouble and downtime.

Darling aluminum alloy valves are available in sizes from ½" through 24". Write us about your requirements and service conditions.

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Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

See why ALCOA ALUMINUM makes a good design habit

Requirement: Simple, low-cost heated lines to pipe high viscosity fluids
Key to Good Design: Specify UNITRACE and DUOTRACE, Alcoa's extruded aluminum pipes with integral steam chambers

With the development of UNITRACE® Piping, ALCOA created an entirely new technique for piping viscous fluids. Trace and product chamber are extruded in a single unit of light, strong, corrosion-resistant ALCOA® Aluminum. This integral steam-traced pipe eliminates the need for cumbersome, costly, inefficient pairing of separate pipes for steam and product. The resultant savings in initial cost are coupled with a major increase in the efficiency of heat application to the product piped.

Subsequent development of special flanges, elbows, adapter flanges and UNITRACE Trace Caps has made it possible to design and install completely integrated UNITRACE piping systems . . . compatible with standard piping components.

Now ALCOA has developed a new product, DUOTRACE,* to expand the design range of integrally traced piping systems. DUOTRACE contains not one but *two* trace chambers plus a product chamber in a single extruded aluminum pipe. This makes DUOTRACE the perfect solution to the need for recirculating tracing systems.

*Trademark of Aluminum Company of America

Today, the ingenuity of process industries designers has indicated intriguing new areas of potential use for both UNITRACE and DUOTRACE. Consider, for instance, the process economies which can result from the substitution of either UNITRACE or DUOTRACE for unit heat exchangers and preheaters.

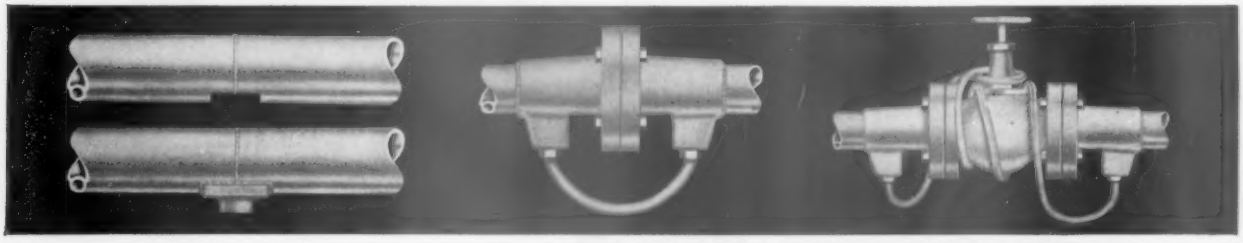
Here you see an outstanding example of the way in which ALCOA is putting over 40 years of process industries experience to work to make aluminum your good design habit. You are invited to share that experience—through a series of engineering conferences which ALCOA is holding this year in a number of major cities. Your local ALCOA sales office will be happy to furnish details.

Take advantage, too, of the body of ALCOA literature which describes in technical detail the known performance characteristics of aluminum in a variety of process industries applications. Simply fill in and mail the coupon opposite. ALUMINUM COMPANY OF AMERICA, Alcoa Building, Pittsburgh 19, Pa.

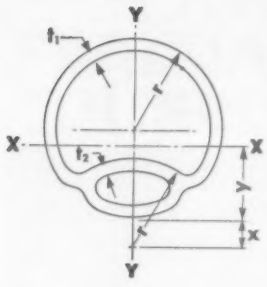
World wide sales through ALCOA INTERNATIONAL, INC., 230 Park Avenue, New York 17, N.Y.

The development of DUOTRACE has opened broad new areas of design exploration in the field of heat transfer. By adding a second trace chamber to the one previously available in UNITRACE, DUOTRACE permits recirculation of the trace fluid. This opens up a whole new area of heat transfer design. Not the least of the possibilities is this: certain types of heat exchangers may now be extruded as single units. The cost savings implicit in such a unit are almost staggering. Alcoa engineers will be happy to assist you in exploring such design innovations in your own plant or process.

Fittings and connections for UNITRACE and DUOTRACE: Unflanged connections can be made easily and effectively with the special UNITRACE Trace Cap. As illustrated, trace chambers in adjoining sections are cut back and a circumferential weld is made to seal the product chamber. The cut back trace section is then covered with a UNITRACE Trace Cap welded in place with 4043 weld wire. Simple, efficient **flanged connections** utilize special UNITRACE flanges designed to accommodate both trace and product chambers. Jumper connections are used to carry the trace across the connection, and special impingement plates in the flange shield the product chamber from erosion as steam passes through the flange. **Valves, pumps and other fittings** can be incorporated into the traced systems by using UNITRACE flanges which mate with all 150-lb ASA flanges, valves and pumps. UNITRACE and DUOTRACE systems accommodate standard preformed pipe insulation.

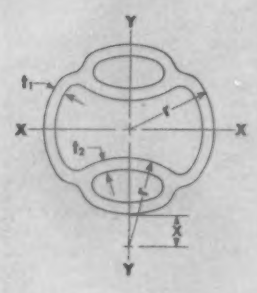


UNFLANGED CONNECTIONS FLANGED CONNECTIONS VALVES AND FITTINGS



	Unitrace Sizes	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	8 in.
Axis XX	Moment of Inertia (I) in.⁴	.09	.34	.72	2.71	6.52	31.82	81.82
	Radius of Gyration (R) in.	.37	.58	.72	1.09	1.42	2.12	2.78
	Section Modulus (S) in.³	.13	.34	.56	1.42	2.65	8.73	17.22
Axis YY	Moment of Inertia (I) in.⁴	.09	.33	.70	2.65	6.36	29.72	76.70
	Radius of Gyration (R) in.	.37	.57	.71	1.08	1.40	2.05	2.69
	Section Modulus (S) in.³	.14	.34	.59	1.52	2.83	8.97	17.79

Sizes	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	8 in.
r	.657	.950	1.187	1.750	2.250	3.312	4.312
t_1	.133	.145	.154	.170	.187	.280	.322
t_2	.145	.163	.174	.185	.200	.307	.354
x	.133	.344	.406	.625	.813	1.500	2.000
y	.61	.87	1.08	1.59	2.03	2.98	3.87



	Duotrace Sizes	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	8 in.
Axis XX	Moment of Inertia (I) in.⁴	—	—	.80	3.06	7.53	—	—
	Radius of Gyration (R) in.	—	—	.74	1.12	1.46	—	—
	Section Modulus (S) in.³	—	—	.68	1.75	3.35	—	—
Axis YY	Moment of Inertia (I) in.⁴	—	—	.67	2.59	6.29	—	—
	Radius of Gyration (R) in.	—	—	.68	1.03	1.33	—	—
	Section Modulus (S) in.³	—	—	.57	1.48	2.80	—	—

Sizes	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	8 in.
r	—	—	1.187	1.750	2.250	—	—
t_1	—	—	.154	.170	.187	—	—
t_2	—	—	.174	.185	.200	—	—
x	—	—	.531	.843	1.125	—	—
y	—	—	—	—	—	—	—

Unitrace-Duotrace Sizes	1 in.	1½ in.	2 in.		3 in.		4 in.		6 in.	8 in.
Product Area (in.²)	.64	1.68	2.72	2.36	6.38	5.67	10.84	9.74	24.64	42.79
Trace Area (in.² each)	.10	.16	.35	.22	.98	.61	1.86	1.07	2.85	5.12
Metal Area (in.²)	.65	1.03	1.39	1.46	2.28	2.46	3.24	3.53	7.05	10.60
Weight (lb/ft)	.77	1.22	1.66	1.72	2.71	2.89	3.85	4.16	8.38	12.60
*Min. Bend Radii (in.)	5	8	10½	10½	17	17	24	24	36	48
Wetted Perimeter (in.)										
Product	3.35	4.92	6.31	6.28	9.68	9.65	12.72	13.02	18.63	24.75
Trace (each)	1.49	1.71	2.40	1.87	4.13	3.22	5.32	4.23	6.75	9.63
Fitting Weights (lb)										
Trace-Caps	.102	.126	.240	.13	.464	.40	.674	.55	1.67	2.92
Elbows	.706	1.347	2.111	2.65	5.244	6.59	9.649	11.68	27.76	52.51
Impingement Plates	.024	.039	.057		.101		.162		.22	.34
Stub Ends				.65		1.50		2.13		
Terminal Casting				.50		1.12		1.75		

	1–2 in.	1½–2½ in.	2–3 in.	3–4 in.	4–6 in.	6–8 in.
Adapter Flanges	2.419	3.816	4.774	7.216	11.106	19.23

(Note: UNITRACE values are indicated in clear areas in the table above. DUOTRACE values are shown in the shaded areas.)
*Unitrace may be bent in any direction to these radii provided reasonable tooling is employed.

Aluminum Company of America, 865-G Alcoa Building, Pittsburgh 19, Pa.
Please send me the following literature covering Alcoa Aluminum for tubular products and other uses in the process industries:

☐ 10197 Aluminum Pipe and Fittings
☐ 10418 Alcoa Unitrace: Combines Piping and Tracing in One Unit
☐ 514 Alcoa Duotrace Technical Report
☐ 10270 Alcoa Utilitube
☐ 10460 Process Industries Applications of Alcoa Aluminum
☐ 11453 Solving Refinery Corrosion Problems with Aluminum
☐ 20849 Resistance of Aluminum Alloys to Weathering and Resistance of Aluminum Alloys to Chemically Contaminated Atmospheres
☐ 20437 Aluminum Alloy Heat Exchangers in the Process Industries
☐ 19416 Brazing Alcoa Aluminum
☐ 19415 Welding Alcoa Aluminum
☐ 19051 Alcoa Aluminum Handbook

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27-29 Mid-West Gas Association, annual school and conference, Memorial Union, Iowa State College, Ames.

29-30 Mid-Continent Oil and Gas Association, Mississippi - Alabama division meeting, Grand Hotel, Point Clear, Ala.

29-Oct. 1 West Texas Geological Society, field trip, Delaware Basin of West Texas and southeast New Mexico.

OCTOBER

2-5 Society of Petroleum Engineers of AIME, annual fall meeting, Denver.

3-4 Independent Natural Gas Association of America, annual meeting, Fontainebleau Hotel, Miami Beach.

4-5 University of Kansas, gas-measurement institute, National Guard Armory, Liberal, Kans.

6-7 National Association of Corrosion Engineers, annual western region conference, Sheraton-Palace Hotel, San Francisco.

6-8 National Association of Corrosion Engineers, southeast region conference, Dinkler-Plaza Hotel, Atlanta, Ga.

6-8 National Academy of Sciences, National Research Council, ninth national clay conference, Purdue University, Lafayette, Ind.

10-12 American Gas Association, annual convention, Atlantic City.

11-14 National Association of Corrosion Engineers, northeast region conference, Prichard Hotel, Huntington, W. Va.

12-14 Southwestern Federation of Geological Societies, annual meeting, Wooten Hotel, Abilene, Tex.

13-14 California Natural Gasoline Association, annual fall meeting, Hotel Miramar, Santa Monica, Calif.

13-16 Taft, Calif., Oildorado, fiftieth anniversary celebration.

17-19 American Society of Mechanical Engineers, American Society of Lubrication Engineers, lubrication conference, Statler Hilton Hotel, Boston.

17-19 University of Minnesota, Pennsylvania State University, Colorado School of Mines, biannual symposium on drilling and blasting, Golden, Colo.

19-20 National Association of Corrosion Engineers, north central region conference, Schroeder Hotel, Milwaukee.

19-21 Gulf Coast Association of Geological Societies, convention, Biloxi, Miss.

19-21 Rocky Mountain Oil and Gas Association, annual convention, Brown Palace Hotel, Denver.

20-21 American Institute of Mining, Metallurgical, and Petroleum Engineers, Los Angeles Basin, fall meeting, Huntington Sheraton Hotel, Pasadena, Calif.

20-23 Odessa Oil Show, Odessa, Tex.

23-25 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

24-25 American Society of Mechanical Engineers, American Institute of Electrical Engineers, fuels conference, Daniel Boone Hotel, Charleston, W. Va.

25-28 National Association of Corrosion Engineers, south central region conference, Mayo Hotel, Tulsa.

26-27 Armour Research Foundation of Illinois Institute of Technology, computer applications symposium, Morrison Hotel, Chicago.

26-27 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.

28 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

NOVEMBER

3-4 American Association of Petroleum Geologists, Pacific section, annual meeting, Ambassador Hotel, Los Angeles.

3-4 Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.

6-9 Chemical Institute of Canada, chemical engineering division, conference, Quebec City.

7-10 Society of Exploration Geophysicists, international meeting, Moody Convention Center, Galveston, Tex.

14-16 American Petroleum Institute, fortieth annual meeting, Conrad Hilton, Palmer House and Congress hotels, Chicago.

15-16 University of Kansas, natural-gas pipeline institute, Courthouse, Liberal, Kans.

18 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.

27-Dec. 2 American Society of Mechanical Engineers, winter annual meeting, Statler Hilton Hotel, New York.

DECEMBER

4-7 American Institute of Chemical Engineers, meeting, Statler Hotel, Washington.

5-7 Interstate Oil Compact Commission, annual meeting, Westward Ho Hotel, Phoenix.

HILLMAN-KELLEY

Power Casing Tongs

a field-proven tool which provides fast, uniform make-up of the casing string without use of spinning rope or cathead. FAST, SAFE, ECONOMICAL

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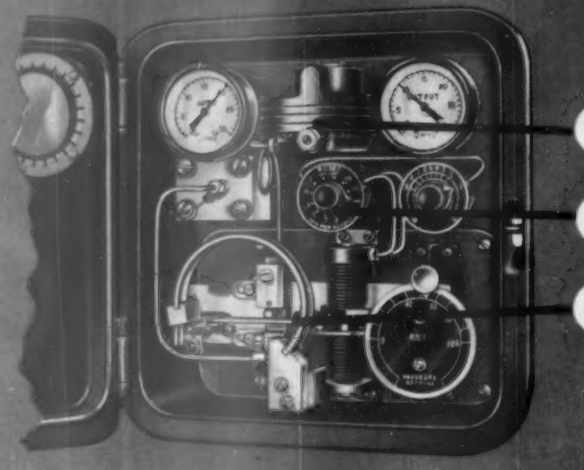
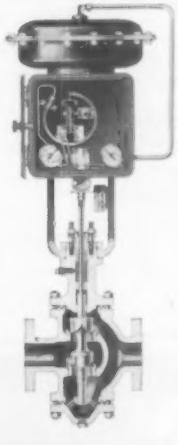
ask your FISHER/MAN about the

WIZARD II PRESSURE CONTROLLER with new and improved features



1. **VOLUME RELAY** for faster response to pressure changes.
2. **RESET FEATURE** for greater stability and pin-point control, adjustable from .005 to 1 minute per repeat.
3. **MEASURING ELEMENT** may be brass, steel or stainless steel Bourdon tubes for pressures from 30 to 15,000 psi or Bellows assemblies for pressures below 30 psi and vacuum.

WIZARD I PRESSURE CONTROLLER



The original Wizard I Pressure Controller is still available for those applications not requiring volume relay or reset features. The simplicity of a self-operated regulator and the accuracy of a pilot or relay operated regulator are found in the Series 4100U. This is, unquestionably, the reason for the continued popularity of the Wizard I series.

As for all Wizards, the Series 4100U is furnished with a universal case which enables the unit to be flush or surface mounted or mounted on yoke of a control valve. Measuring Elements: Bourdon Tube—Bronze, Steel or St. Steel—Ranges 25 to 7,500 psi. Bronze or St. Steel Bellows for vacuum to 25 psi.

The Wizard II has been designed to specifically meet the demands of modern, complex systems requiring closer and faster control. The Wizard II retains the basic simplicity and dependability of the Wizard 4100U, plus more speed and accuracy.

The new design consists of two sub-assemblies encased in a weather proof die cast aluminum housing which is provided with a ¼" pipe threaded vent. Either sub-assembly can be removed without disturbing case mounting. The simple but effective proportional band adjustment (2 to 100%) and the reset adjustment (.005 to 1 min/repeat) along with ease of reversing the action of the Wizard II, have contributed much to its popularity in process control work. All Wizard II controllers, with exception of differential models, can be supplied with a process or controlled pressure gauge installed inside the case.

Careful and exhaustive tests and years of field use have conclusively proved that the Wizard II measures up to rigid Fisher standards.

A COMPLETELY DESCRIPTIVE AND ILLUSTRATED BULLETIN ON THE WIZARD II IS YOURS FOR THE ASKING. WRITE FOR BULLETIN No. D-4150B OR BULLETIN D4100 ON WIZARD I.

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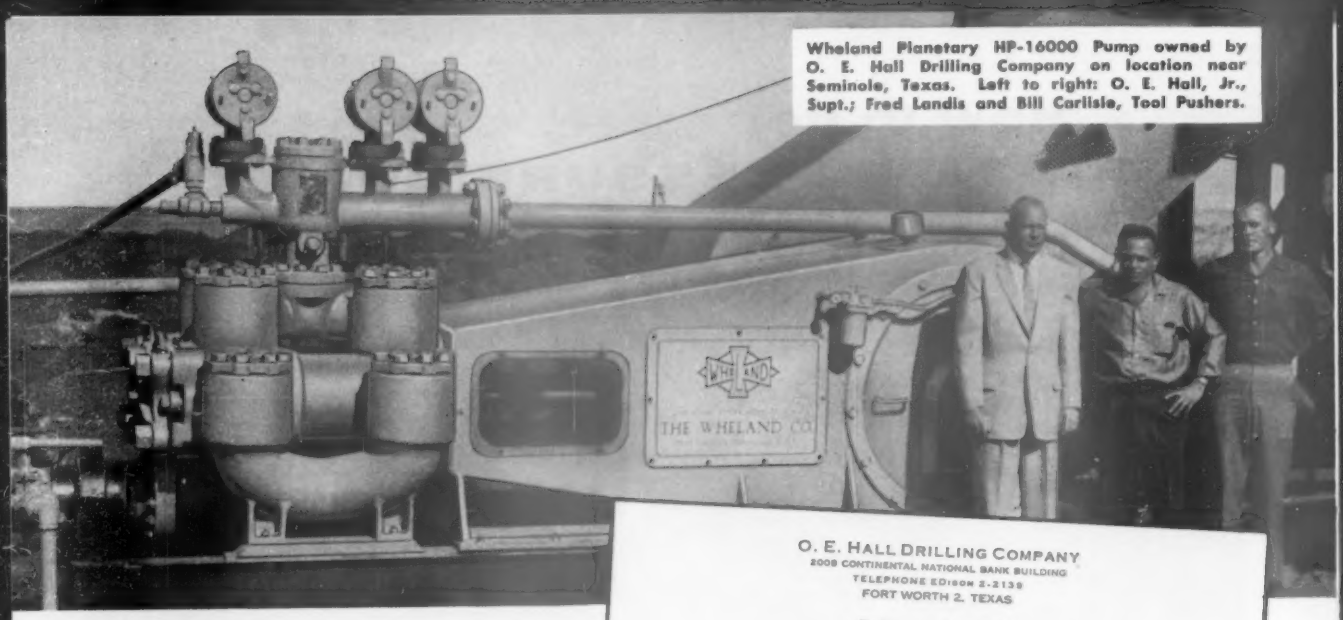

Wheland Planetary HP-16000 Pump owned by O. E. Hall Drilling Company on location near Seminole, Texas. Left to right: O. E. Hall, Jr., Supt.; Fred Landis and Bill Carlisle, Tool Pushers.

"... the pump has improved our operation ... we will be happy to recommend it."

O. E. HALL, Jr.

O. E. HALL DRILLING COMPANY
2008 CONTINENTAL NATIONAL BANK BUILDING
TELEPHONE EDison 2-2139
FORT WORTH 2, TEXAS

February 16, 1960

The Wheland Company
Signal Mountain Road
Chattanooga, Tennessee

Mr. Gordon L. Smith, Jr.
Manager Rotary Drilling Equipment Sales

Dear Mr. Smith:

We thought you would be interested to know how pleased we are with the performance of our Wheland Planetary HP-16000 Pump. It is the smoothest running pump we have seen. The big gear reduction makes possible such a small sheave and the pump pulls very easily. We are also impressed by the compactness of the gear cartridge and the smooth performance of the new circular crosshead. In the several wells we have drilled thus far the pump has improved our operation in terms of penetration rate and savings in bits. Also has exceeded our expectations.

All of these wells have been located in West Texas. We operate our rigs throughout the Permian Basin covering a depth range of 4, 500 feet to 12, 500 feet with modern equipment.

We want to commend The Wheland Company for stepping forward with this improved design in slush pumps, and we will be happy to recommend it.

Very truly yours,

O. E. HALL DRILLING COMPANY
O. E. Hall Jr.
O. E. Hall, Jr.
Midland, Texas

WHELAND PLANETARY HP-16000 PUMP

Duplex Power Slush Pump

7 ¾"x 16", 600 HP at 65 RPM

WHELAND

ROTARY DRILLING MACHINERY

THE WHELAND COMPANY

CHATTANOOGA, TENNESSEE, U.S.A.

DRAW WORKS • SLUSH PUMPS • ROTARIES
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the Journal said...

50 years ago

July 21, 1910

California's notorious Lakeview gusher at Midway last week began to show signs of weakening after flowing unabatedly out of control since March 15. Settling to a daily flow of about 20,000 bbl., it failed to come back as it had been doing with one of its previously frequent terrific surges, some of which have been up to 90,000 bbl. daily. Also water appeared for the first time. In its nearly 130-day rampage, the well has produced more than 4,800,000 bbl. of oil in earthen reservoirs.

The wildcat test being drilled by Gulf Refining Co. at Hackberry, on the shore of Calcasieu Lake, in Cameron Parish, south of Lake Charles, on the Louisiana Gulf Coast, has been shut down because of mosquitoes which are so numerous and vicious, drilling crews cannot work.

Work begins on Arkansas Natural Gas Co.'s projected 235-mile natural-gas line from Caddo field of northwestern Louisiana to Little Rock, Ark. A specially designed barge has been built to transport the 10, 12, 16, and 18-in. pipe for the line by way of river routes.

25 years ago

July 18, 1935

A new motor fuel in the form of a jellylike mass called "solid gasoline" makes its debut in a practical demonstration in New York at the Daniel Guggenhiem School of Aeronautics. Sponsors claim use of the fuel is safer because it does not ignite except in direct contact with flame, and does not spill.

A new major oil field (Rodessa) is indicated by United Gas Public Service Co.'s discovery of the first production in Louisiana from the Trinity horizon. United's discovery well, 1 Young, in the old Caddo Parish area flows 15,000 bbl. of 42°-gravity oil and 25 to 40 M.M.c.f. of gas daily from the new deep pay.

10 years ago

July 20, 1950

First tidelands drilling in Germany gets under way off Cuxhaven on the North Sea at the mouth of the Elbe River. Three companies — Preussag, Deutsche Erdoel, and Deutche Vacuum—share operation from steel platform 1½ miles offshore.

El Paso Natural Gas Co. wins 2-year fight for authority to construct a natural-gas pipeline from the San Juan basin gas area in northwestern New Mexico to the Colorado River to connect with Pacific Gas & Electric Co.'s existing line to the San Francisco Bay area. Federal Power Commission approves projected 451-mile, 24-in. line with initial capacity of 150 M.M.c.f. of gas daily.

JOURNALLY SPEAKING

The IBM Mentality

ABOUT 100 YEARS AGO when the world's navies were mechanizing, shifting from sail to steam, and building ironclad warships, old-time windjammer sailors deplored the trend as a shift from "iron men in wooden ships to wooden men in iron ships."

We are wondering if present-day business executives may not be in danger of becoming "wooden men with IBM brains."

We use the expression with an apology to International Business Machines Corp., and point out that that company uses as its motto "THINK," which should be a reminder that its machines do everything else but.

What we are afraid of is that some executives may do everything else perfectly except to think. They are so surrounded by electronic calculating machines that they could easily slip into what, for lack of a better term, we call the IBM mentality.

A calculating machine, you know, never makes a mistake. It always comes up with a mathematically perfect decision—provided that all pertinent data have been fed into it. Such machines can take over so much mental effort that it is easy to fall into the assumption that they actually think.

But of course they don't think. Thinking, and making business decisions, involves the use of factors which can't be programed for automatic processing. All that a computer can do is to assemble the material for genuine thinking and decision making.

For example, a machine could not possibly recommend a course of action in which the odds for success are unfavorable on the basis of the data put into it. Yet business success so often depends on taking chances and playing hunches against unfavorable odds.

Suppose, for instance, that a computer is depended on for oil exploration. The geologists and the geophysicists evaluate all possible information about the company's wildcat leases. They get all the factors properly weighted and reduced to a binary code or whatever it takes to program the data for electronic processing.

The machine whirs and blinks and finally types out the conclusion that the odds against finding oil or gas in paying quantities in a certain area are too great, and those leases should be dropped.

This would be a complete answer for an executive with an IBM mentality. He has mathematical proof that there is no oil there. So he drops the leases—and some imaginative wildcatter adds his own thinking to the work done by the electronic "brain" and discovers a big field.

See what we mean? The same principle applies to other types of business decisions, like operating a refinery. A computer can figure out that the company will make the most money by running so many barrels of a certain type of crude through a particular cycle of processes and get so many gallons of each product at such and such a price.

But what will that do to such things as crude-supply arrangements, dealer relationships, or the condition of the market? Those are factors in the decision that must be added by a human evaluator after the machine has done its work.

Likewise, say, in corporate reorganization. The machine—or the IBM mentality operating like a machine—may say that the company will make more money if it merges with XYZ Co., closes this and that office, and fires such and such people. But that type of "thinking" simply can't evaluate such factors as human, government, and public relations.

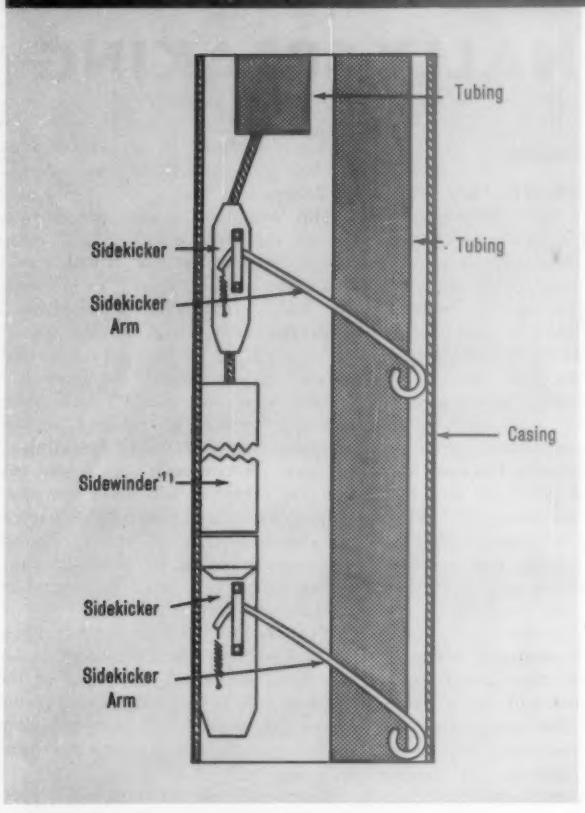
The IBM mentality may never do anything wrong. But that's not at all the same as doing things right. It may never make a mistake but neither does it make any experiments or any progress. It has no individuality, no personality, no humanness, no horse sense, no sex appeal.

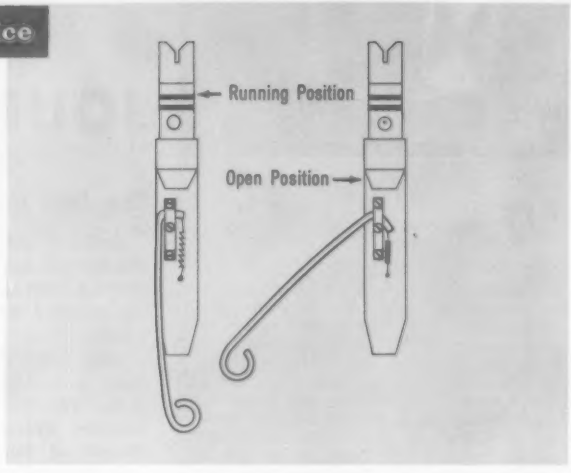
Far from eliminating the need for personal judgment, an IBM machine intensifies that need by clearing away the mechanical underbrush so that the areas for thinking and decision become more evident.

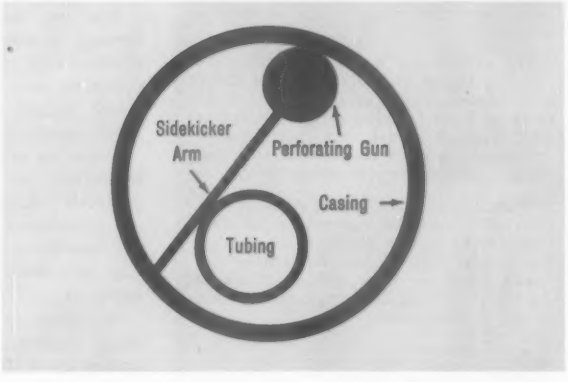
As an example, we heard of a bunch of scientists trying to develop a machine to translate foreign languages. It worked fairly well on straight technical matter. But then they fed it "The spirit is willing but the flesh is weak," and out came the literal translation: "The whisky is potent but the meat is spoiled."

—Henry D. Ralph

Revolutionary New Completion Service







Sidekicker Solves Dual PWC* Problems

*** Permanent Well Completions**

Welex engineers have answered the problem of perforating an upper zone with no risk to the adjacent tubing string in dual permanent well completions. The new development — another first by Welex — offers these advantages:

- Service can be performed through 2″ tubing and standard seating nipples.
- The Sidekicker, a mechanical orienting decentralizer developed by Welex, forces the Sidewinder[1] perforating gun against the side of the casing, assuring maximum penetration.
- The Sidekicker positions jet gun so that the charges will fire outward through the casing — never in the direction of the adjacent tubing string.
- Sidewinder[1] retrievable carrier absorbs the shock of detonation, protecting adjacent tubing string from damage.
- Absolutely no debris is left in the hole. All debris is retained in the carrier and returned to the surface.

Welex, the company that originated jet perforating proudly adds this new service to the other "firsts" that it has introduced to the oil industry.

In Permanent Well Completions, as well as in other types of completions, Welex has a complete set of tools for every job. Next time and every time let Welex's completion services work for you.

WELEX, INC.

ORIGINATORS OF Welex JET PERFORATING

General Offices: 1400 East Berry, Fort Worth, Texas
In Canada: Welex of Canada, Ltd.

[1]*Trademark of Jet Research Center, Inc.*

Refiners seem to be fooling themselves

WHAT REFINERS have been doing in recent weeks is an illustration of the oil industry's self-deceiving attitude toward its markets.

For a while, refinery runs were held down a little bit and demand increased a little bit, and the combination was just enough to absorb most of the surplus stocks of gasoline and distillate that had been kicking around at distress prices.

Then bargain hunters had to shop more widely and offer higher prices. At the same time many refiners and marketers resumed their former practice of buying and borrowing small lots of products to meet special market situations or to balance out their production and inventory schedules.

THIS GAVE A SUPERFICIAL impression that demand was booming, material was scarce, and prices were on firm ground. Result: Refinery runs increased far out of proportion to the increase in actual demand.

Now inventories are again so high that distress sales may again pull down the level of the whole market.

Thus any improvement in the petroleum market carries the seeds of its own destruction—so long as oil management takes the attitude that marketing consists only of "getting rid of the stuff."

Every opportunity for profitable operation will be converted into a setup for disaster so long as emphasis is put on filling the market instead of serving it.

The basic trouble with the oil industry is that it has almost always had an expanding demand. Therefore it never had to do much thinking about its markets. Instead it concentrated on increasing supply. This bred the assumption that the road to profit and success is low unit costs achieved by maximum throughput.

So refiners are prone to worship at the shrine of volume. What they call their marketing departments are little more than conduits to move the product, working under orders to get a certain share of the market as measured in gallons rather than profits.

EARLY THIS SUMMER it looked as though most refiners were watching the market and were gearing their output to the needs of consumers instead of to their own volume goals.

But the recent rise in crude runs, far more than called for by the modest pickup in demand, suggests that refiners were watching the market for just one thing—any upward turn that would give them an excuse to get back into the volume race.

The industry's success depends on serving the needs of the market at a profit to itself. It could fool itself into bankruptcy by clinging to the notion that this entails nothing more than high-volume output and high-pressure distribution.

INTRODUCING Poxyglas™

the ALL-NEW type of tank for handling all corrosive fluids common to Oilfield Production!

- ✓ **Sour Crude**
- ✓ **Salt Water**
- ✓ **Fresh Water**
- ✓ **CO_2**
- ✓ **H_2S**
- ✓ **Treating Chemicals**

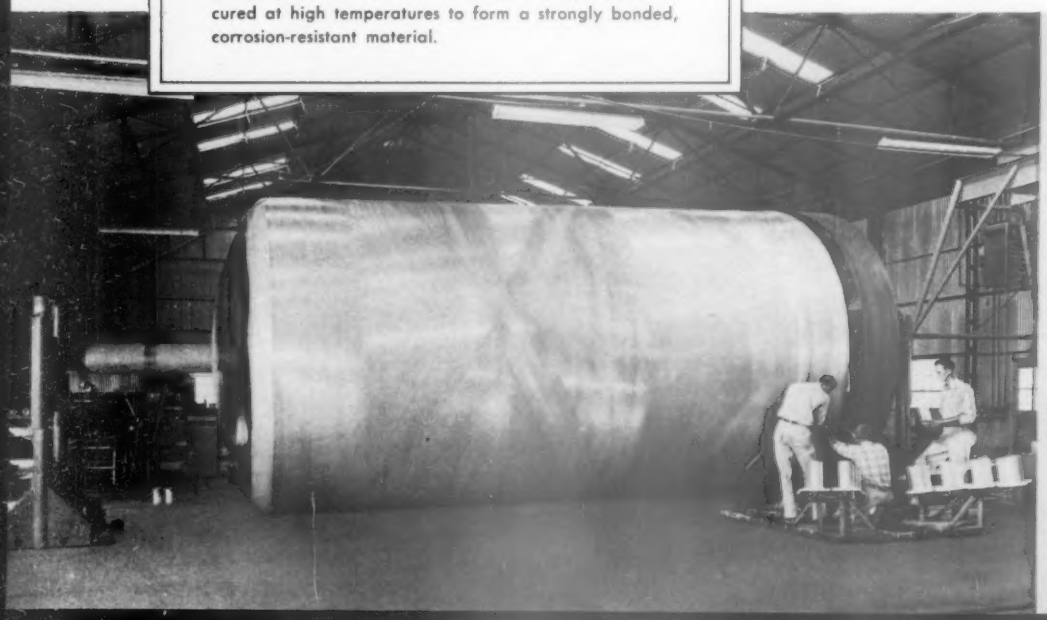
Also ideal for areas where *EXTERNAL* corrosion is a problem . . . or where tank weight is a factor!

WHAT IS *Poxyglas?*

POXYGLAS is BS&B's new corrosion-resistant, high strength, light weight glass-resin material that utilizes a filament winding process. Glass filaments are impregnated with epoxy resin and wound in a precisely controlled pattern onto a mandrel. The catalyzed resin is cured at high temperatures to form a strongly bonded, corrosion-resistant material.

BS&B's Filament Winding Method Has These Important Advantages Over Conventional Methods Of Reinforced Plastic Tank Fabrication:

1. **Tank diameters are consistent** because tanks are wound and cured on steel mandrels. No strapping of tanks necessary. Exact volumes of tanks can be calculated.
2. Filament wound structures are *3 to 4 times as strong* as conventional reinforced plastics. Continuous high strength glass filaments carry the load, thus eliminating plastic creep.
3. Completely *controlled glass pattern*. Glass filaments are wound under tension onto a mandrel in a calculated pattern for maximum strength.
4. **Consistent glass-to-resin ratio** is insured by controlled glass impregnation. Every fila ment is thoroughly covered with epoxy.
5. **Production type operation.** BS&B winding machines have high winding rates with maximum versatility and performance capabilities.
6. **Epoxy-rich inner layer** of the tank eliminates "wicking action", gives a 100% corrosion-resistant inside surface.



POXYGLAS tanks are wound on mandrels controlled by a programmed electro-hydraulic servo system developed by BS&B.

This battery of two 12' x 20' POXYGLAS tanks is used to handle corrosive crude.

WHY *Poxyglas*?

Lowest in cost for true corrosion protection....

POXYGLAS combines corrosion-resistant glass and corrosion-resistant epoxy with filament winding to produce a tank that will handle all types of corrosive oilfield service and many chemical plant services where corrosion or product contamination are problems.

Absence of corrosion means low maintenance....

Inspection and recoating costs are eliminated.

POXYGLAS is light weight and has high strength characteristics....

POXYGLAS tanks are approximately one-eighth the weight of a comparable steel tank. Strong, lightweight tanks can be handled with a minimum amount of equipment. Easy to move and reset.

Competitively Priced....

POXYGLAS tanks cost less than redwood tanks, and are competitively priced with welded steel tanks that have been internally coated for corrosion resistance.

POXYGLAS TANK SIZES

Tank No.	Capacity Barrels*	Diameter Feet	Height Feet	Approximate Weight
45-05-001-01	110	10.	8.	900
45-07-001-01	200	12.	10.	1050
45-05-002-01	210	10.	15.	1050
45-05-003-01	280	10.	20.	1350
45-07-002-01	300	12.	15.	1300
45-07-003-01	400	12.	20.	1500

* 42 gallon barrels.

STANDARD FITTINGS AND ACCESSORIES

1 — 4" Gas Equalizer
1 — 4" Fill Line
1 — 4" Vent Line
1 — 4" Drain
1 — 4" Pipe Line
2 — 4" Overflow
1 — 8" TF92G-PB Thief Valve
1 — 18½" x 14" Elliptical Manhole

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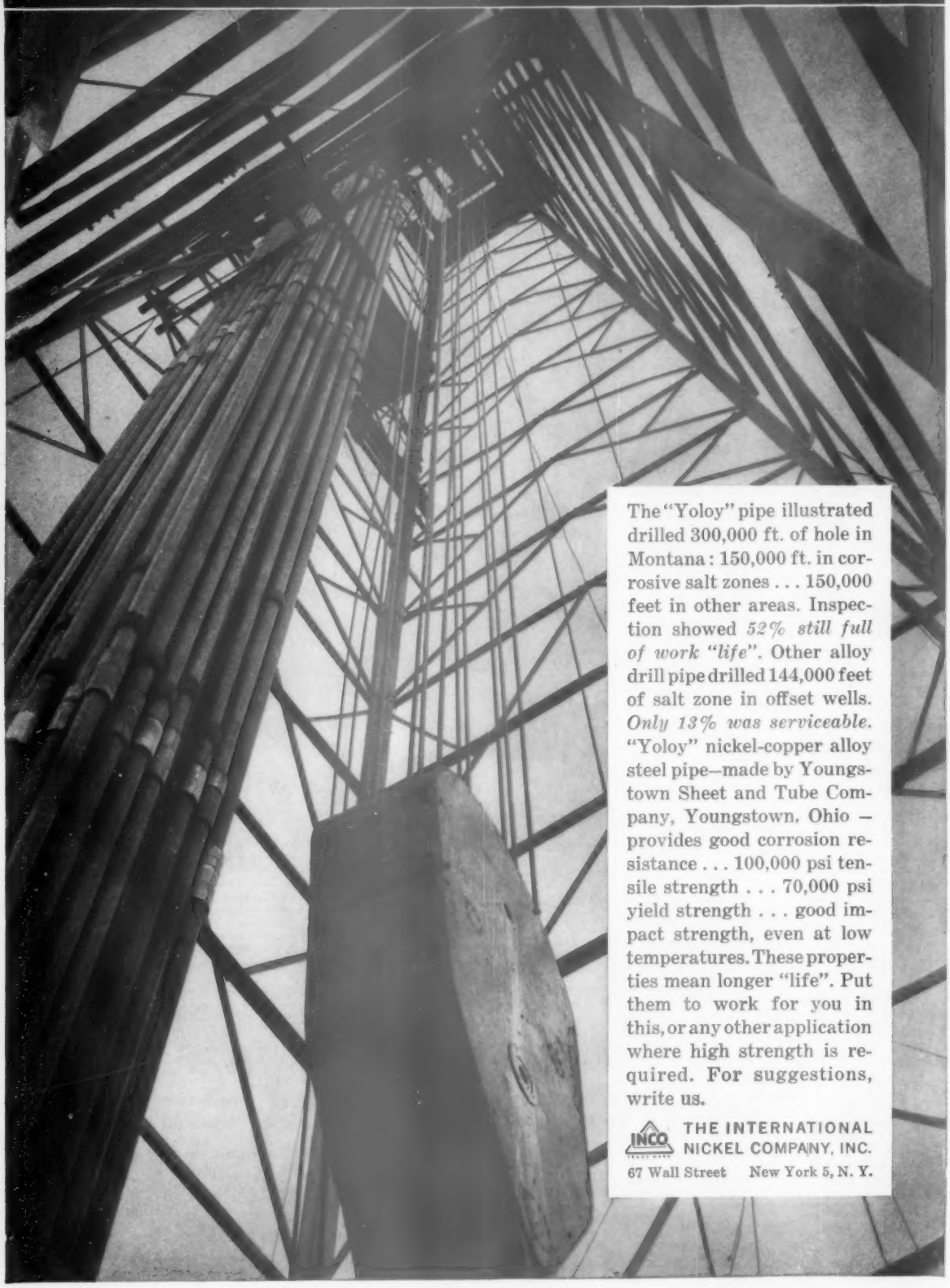
"Yoloy" drill pipe "lives" longer



The "Yoloy" pipe illustrated drilled 300,000 ft. of hole in Montana: 150,000 ft. in corrosive salt zones . . . 150,000 feet in other areas. Inspection showed *52% still full of work "life"*. Other alloy drill pipe drilled 144,000 feet of salt zone in offset wells. *Only 13% was serviceable.* "Yoloy" nickel-copper alloy steel pipe—made by Youngstown Sheet and Tube Company, Youngstown, Ohio — provides good corrosion resistance . . . 100,000 psi tensile strength . . . 70,000 psi yield strength . . . good impact strength, even at low temperatures. These properties mean longer "life". Put them to work for you in this, or any other application where high strength is required. For suggestions, write us.

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THE INTERNATIONAL NICKEL COMPANY, INC.

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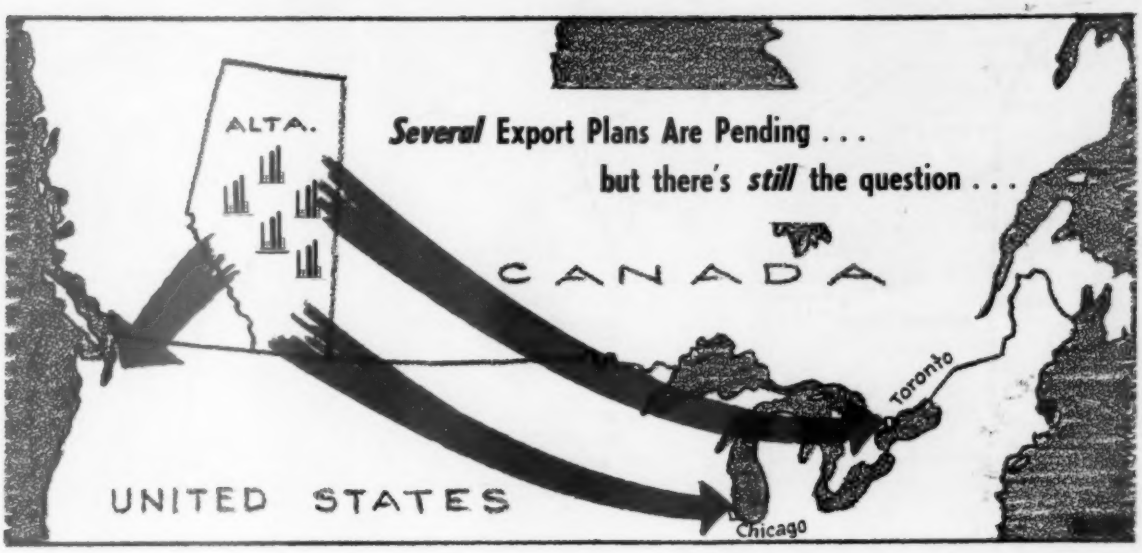


Who'll Buy Alberta's Surplus LPG?

• Four plans are pending for pipelines to move the large volume of liquids which will become available when export of Canadian gas hits its stride. But it's not at all clear yet who the buyers will be for this big surplus.

Gene T. Kinney
Assistant Pipeline Editor

LATE NEXT YEAR Alberta will find itself with a sudden glut of natural-gas liquids, if all proposed plants to process gas for export are built by that time.

Four companies are eager to build pipelines to move the liquids, but the big question needing an answer is: Who will buy the surplus outside of Alberta?

One of the biggest controversies among competing pipelines concerns the size of the surplus, and when it will develop.

It will come as new wet gas fields start producing and new plants begin processing a volume that will eventually reach 650,000,000 cu. ft. daily for export to the western United States, principally California.

This much gas already has been approved by Canadian authorities for movement to the U. S., with permission to start deliveries in the fall of 1961. Federal Power Commission approval is expected momentarily for the Alberta-California project, which will start deliveries at well below the maximum authorized.

Pipelines to carry the gas are due to start construction soon, but actual operations startup is not yet clear, because of regulatory delays, development drilling, plant construction, and market development.

Normal processing operations to handle this much gas will turn out a volume of gas-liquid products ranging somewhere between 60,000 and 91,000 bbl. daily, according to various industry estimates. Whether the surplus will develop overnight, or whether it will build up gradually, is a subject of heated discussion.

Over half of this will be surplus that will be looking for a market.

So far none of the four companies seeking approval of the Alberta Oil and Gas Conservation Board to transport the liquids has presented a clear picture of their ultimate use.

Only Britamoil Pipe Line can back its proposals with guaranteed markets. That is because its parent, British American Oil Co., plans to use the liquids in its own refineries at Calgary and Edmonton.

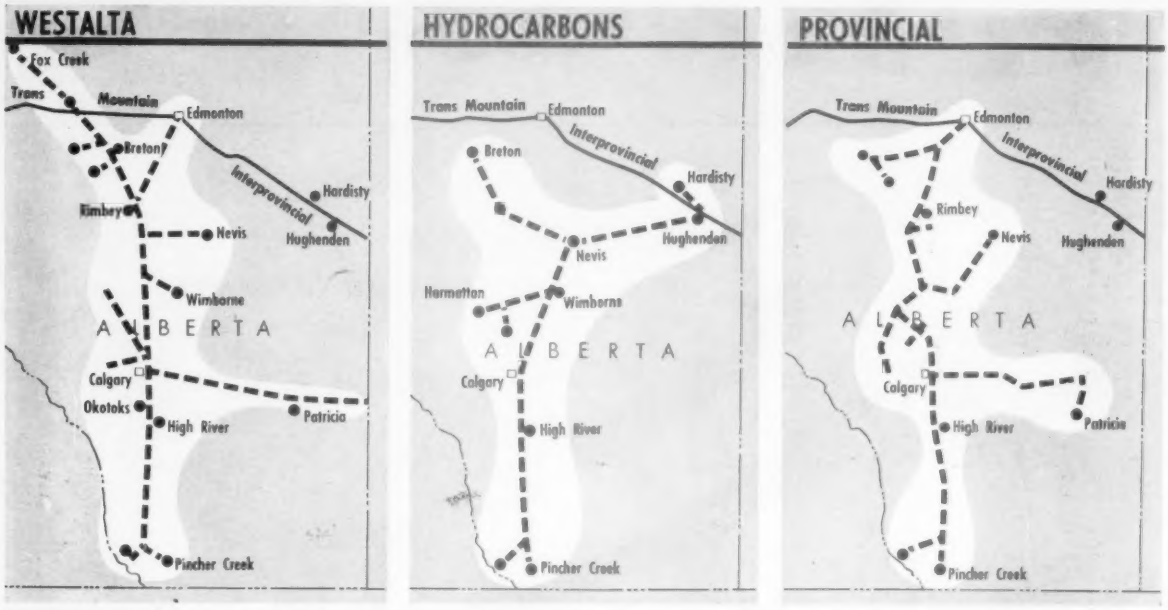
Britamoil takes the stand in Calgary this week to push its plans to connect two B-A gasoline plants to its refineries. Its application doesn't concern itself with the over-all problem of disposing of the output of some 20 plants, only its own.

Westalta-Foothills . . . The first proposal and the most ambitious—and, perhaps for these reasons. the most opposed in the hearings—is advanced by Westalta Products Pipe Line, Ltd., and Foothills Pipe Line, Ltd.

Westalta would take on the job of gathering most of the plant liquids in the province, much in the manner that Alberta Gas Trunk Line Co., Ltd., functions as the official gas-gathering system. Preliminary design has been made by Pipe Line Technologists (Alberta), Ltd.

British American says it needs no help from Westalta or anyone else to move liquids from its Dick Lake and Pincher Creek plants.

The Liquefied Petroleum Gas Association predicts a serious shortage of propane in Canada next winter unless some plants are completed this year.



It wants LPG excluded from authorization for export of condensate until Canadian demand is met.

Canadian Chemical Co., Ltd., wants LPG supplies assured for Alberta petrochemical plants.

Home Oil Co., Ltd., an independent producer, fears sudden large-scale export, such as is proposed to Chicago (68,000 bbl. daily initially), might cause the U. S. to restrict Canadian crude imports.

Hudson's Bay Oil & Gas Co., Ltd., says Westalta would duplicate many existing systems.

But Westalta and Foothills insist that they have worked out the best plan for transporting and marketing the huge volume of liquids.

Hydrocarbons Pipeline . . . This company, Westalta's most vigorous opponent to date, is advancing a completely different approach, on the basis of a preliminary design by Dutton-Williams Brothers, Ltd.

It is emphasizing coordination with other pipelines, including the two proposed by Britamoil, and other existing forms of transportation. Hydrocarbons would export only condensate, a light crude oil, through Interprovincial, which has expressed an interest in transporting it to eastern provinces and Great Lakes area refineries on its system in the U. S.

Hydrocarbons believes the LPG is marketable in western Canada. Its gathering stream would be made up of 7.4% propane, 15.3% butane, and 77.3% condensates and natural gasolines.

Butane and propane would be stripped from the mixed stream for injection into existing underground storage at Hughenden, from which it would be distributed.

Later, when butane and propane surpluses developed, these products would be offered to Trans-Canada Pipe Lines, Ltd., for shipment in its gas stream.

Trans-Canada states that the premiums it pays producers for B.t.u.'s above 1,000 per cubic foot will in future years cost $1.5 million annually. The company receives no credit for extra B.t.u.'s when the gas is sold, and could recover the cost only by selling the liquids.

Trans-Canada could install facilities and actually begin extraction next year to permit advance market building in eastern Canada with extractable liquids present in the gas stream.

How much surplus? . . . The questions of who will win the right to pipeline the liquids, and who will buy them, are bound up in a hassle over how big the surplus is.

Westalta-Foothills predict Alberta LPG production will increase from the current 14,000 bbl. daily to 91,000 bbl. daily in 1962 after the new plants start operating. The companies estimate Alberta demand in 1962 at 23,320 bbl. daily, leaving a surplus for export of 68,000 bbl. daily.

Where can such a surplus be sold? Only in Chicago, with its 600,000-bbl. daily refining capacity, the Pembina-backed group says, on the basis of extensive market studies.

But the Chicago line, in the view of Hydrocarbons Pipeline, is not justified by its own supply forecasts and is therefore premature.

Purvin & Gertz, Inc., Dallas, Tex., in a study prepared for Hydrocarbons, estimates surplus Alberta production in 1962 at 43,600 bbl. daily, about one-third below the Westalta forecast. Purvin & Gertz expect 16,300 bbl. daily (12,700 condensate, 2,000 butane, 1,600 propane) of the surplus to be sold in British Columbia and Washington. Hence only 27,300 bbl. daily (18,100 condensate, 5,000 butane, 4,200 propane) would be available for export east of Alberta.

These figures are based on the assumption that no large-scale petrochemical development will occur locally; they also ignore the volume of propane and butane that may be injected into oil reservoirs in miscible floods.

Based on these lower forecasts, Hydrocarbons favors a less ambitious, more "orderly" approach, rather than the $150-million Westalta-Foothills project. Surplus capacity is available in both Interprovincial Pipe Line to the east and Trans Mountain Oil Pipe Line to the west with markets equal to Chicago.

Marketing factors . . . Except for those who fear a U. S. imports crackdown, the Chicago market has one major virtue in the eyes of Canadian producers:

Sales in Chicago would displace no Canadian crude, since none has ever been marketed there.

On the other hand, use of Alberta condensate by refineries on the Trans Mountain or Interprovincial export lines would compete directly with Canadian crude.

Large-scale influx of Canadian con-

Alberta's Competing LPG Projects

Westalta Products Pipe Line, Ltd., proposes an 885-mile 4 to 16-in. gathering system in Alberta costing $40 million, and Foothills Pipe Lines, Ltd., a connecting 1,300-mile 16-in. trunk line to Chicago, starting at the Alberta-Saskatchewan border; throughput estimated at 73,800 bbl. daily, starting in 1962, and increasing to 190,000 bbl. daily by 1976, with deliveries to Calgary, Edmonton, and Chicago. Both companies are backed by Pembina Pipe Line, Ltd., Calgary.

Hydrocarbons Pipeline, Ltd., subsidiary of Canadian Hydrocarbons, Ltd., Calgary, proposes a 503-mile 4 to 12-in. gathering system in Alberta costing $13 million; throughput estimated at 54,300 bbl. daily in 1962, and increasing to 91,020 in 1971; deliveries would be made to Calgary, Innisfail, Hughenden storage, and Interprovincial Pipe Line Co.

Provincial Products Pipe Lines, Ltd., proposes a 700-mile 3 to 16-in. gathering system in Alberta costing $25 million, with deliveries to Edmonton for export through Interprovincial and Trans Mountain Oil Pipe Line Co. to eastern Canada and the U. S. Great Lakes area and to British Columbia and Washington. The project is being promoted by N. E. Tanner, former president of Trans-Canada Pipe Lines.

Britamoil Pipe Line Co., Ltd., subsidiary of British American Oil Co., Toronto, proposes a 120-mile 6-in. line from its Pincher Creek plant to Calgary and a 60-mile 8-in. line from its Dick Lake plant near Rimbey to Edmonton. British American would use the product in its refineries.

densate into Chicago would be sure to bring pressure from domestic U. S. producers for imports restrictions to end Canada's present preferred position. Prorating states, now suffering from sharp production cutbacks, would also consider it to be an unneighborly act.

Before stepping down as head of the imports-control program recently, Capt. Matthew V. Carson told Canadian oil men that every effort would be made to accommodate their production in the U. S. But he added an important condition.

He foresaw no change in the program unless some undue effort were made to push into a single U. S. market in a big way. To Westalta opponents this was a clear warning to stay out of Chicago, at least on the scale now proposed.

Since condensate yields virtually no residual fuel, each barrel would yield enough lighter products to displace 1.25 bbl. of crude oil. Westalta-Foothills' proposed throughput would displace 67,800 bbl. daily of U. S. condensate in 1962 and 162,300 bbl. daily in 1976, U. S. producers say, or 84,750 and 202,875 bbl. daily of crude in 1962 and 1976.

All of the Chicago refiners have been approached by Foothills. Some of them have an interest in using the Canadian condensate, because sister companies are involved as producers. But the product would compete with their present crude-oil supplies, in large part their own production.

Independent refiners would be interested—if the price were right.

One price mentioned would net Alberta producers $1.09 to $1.68 a barrel, figuring a pipeline transportation cost of 80 cents a barrel and a delivered price of $1.89 to $2.48, depending on the product. One major Chicago refiner, questioned about his plans, said his company would have to look hard at the proposition if the condensate price were brought down to about $2.

The Westalta-Foothills promoters have expressed confidence they can obtain support—although no throughput guarantees—from Chicago refiners by this fall, sufficient to finance their project.

Which pipeline? . . . The Alberta board will have to decide among the competing applicants after appraising much conflicting data supplied by "expert" witnesses.

The board must first make up its mind about some basic facts. First of all: Is a serious surplus actually threatened?

If it accepts Westalta's data on surplus output, then the board must decide whether to commit the entire volume in a commingled stream (15% propane and butane, 85% condensate) to a single market—Chicago.

The condensate would be taken by refiners, with marketing of the LPG taken over by a leading U. S. marketer with Alberta product to dispose of. The LPG would have to compete with Southwest product from several pipelines in the Chicago area and also from Mid-America Pipeline Co., which will start operating lines to Minneapolis, Minn., and Madison, Wis., this winter.

If the board decides a surplus of the magnitude suggested by Westalta is not imminent, then it can authorize a gathering system to feed existing export lines. And there is a good possibility that Alberta condensate will end up in Chicago, if not by the route now proposed or in such large volumes.

Condensate is being considered by Minnesota and Wisconsin refiners connected to Interprovincial and Minnesota Pipe Line, which takes off from Interprovincial at Clearbrook, Minn., and extends to Minneapolis.

In the beginning, condensate could be taken from Interprovincial at Superior and barged or shipped by rail to Milwaukee and Chicago. This would suit the handling of a small initial seasonal demand for condensate, whose high light-products yield fits summer refinery requirements.

If volume later justified, an extension of Minnesota Pipe Line or Interprovincial to Chicago, now being considered, could be made.

Should the Alberta board reject the Chicago export line, the first sections of an Alberta system will be built next year. Britamoil's lines, having an established supply and market, will likely be first, with other plant connections being made as they are completed and liquid output grows.

Opponents of the Chicago line express fear that if it is authorized, it will actually retard Alberta development rather than stimulate it. They reason that feasibility of such a project is years away because of supply and market problems; in the meantime, local lines to existing export outlets which could be justified in the beginning would be blocked.

LPG Salt-Cavern Storage Suit May Be Settled

. . . out of court with Richardson interests. Case stricken from Amarillo docket, purchase of patent being discussed.

AN OUT-OF-COURT settlement of the controversial Sid Richardson patent case, involving withdrawals of LPG from salt cavern underground storage, now appears a possibility.

Trial of a suit, asking four companies to pay ⅛ cent a gallon royalty for LPG taken from storage in Carson and Hockley counties, Texas, since 1957, was stricken from Amarillo federal court docket last week. It was postponed indefinitely.

Several companies last week were known to be discussing the possibility of purchasing the patent or obtaining some sort of licensing arrangement which would grant immunity to the patent.

The late Sid Richardson, patent owner, also had asked triple damages and a permanent injunction against further product withdrawals.

Speculation indicates several possible routes if an out-of-court settlement is sought by principals in the suit.

Title to the patent, purchased by the Richardson interests from its Canadian originator and later reissued to Richardson in revised form, could be transferred in an outright purchase deal. If such a purchase and transfer were consummated, makeup of the new ownership is problematical. Whether it could be taken over by an individual company, or a group of organizations, is a matter of conjecture.

Another possibility could lie in transfer of title to the patent, under agreements which would give worldwide, permanent immunity to storing companies from requirements set out in the patent. This could take the form of a new, broad patent ownership which, in turn, might offer the patent's use royalty free.

Before instituting the suit last year, Richardson representatives contacted oil companies storing LPG in the two counties and offered licenses which required payment of the ⅛-cent-a-gallon royalty.

Two companies were named in the original suit, filed last year. Two others joined as intervenors-defendants. Eleven other companies have interests in the Hockley-Carson county storage projects.

Because of the tremendous growth of LPG business in recent years—with underground storage tripling since 1955—the entire industry has been following the Richardson case with keen interest (OGJ, Sept. 28, 1959).

Approximately 50 companies are engaged in underground storage of LPG in the U. S. Of the nation's 49,000,000 bbl. of underground storage capacity, about 80% is in salt formations.

The Richardson patent, reissued 4 years ago, covers storage of any product in facilities "formed by dissolving the salt with water and removing the so-formed brine."

U. S. Opens Atlantic Tidelands

THE STAGE is being set for preliminary oil and gas exploration in federal submerged lands off the Atlantic coast.

Interior Department announced last week that it plans to grant permits for geophysical and geological exploration of the outer continental shelf along Atlantic Coast states.

Interior said it was taking the action because it had already received applications for permits from two firms—Offshore Exploration Group of Houston and from Kerr-McGee Oil Industries, Inc., requesting authorization to conduct geophysical surveys this summer or fall.

One of the applications was for an area off the coast of Georgia. The other was for an area off Virginia, Maryland, Delaware and New Jersey. Interior said it expects that additional applications will be received from other firms soon.

Exact terms and conditions governing issuance of the permits will not be made until after Interior has received and studied comments from persons interested. In a notice published last week in the government's Federal Register, Interior specified the following conditions:

. . . **That a permit** be obtained from the regional oil and gas supervisor of the U. S. Geological Survey.

. . . **That a company's operations** be limited to the area designated in the permit.

. . . **That the firm agree** to comply with requirements relating to the protection and conservation of aquatic life as specified by the regional oil and gas supervisor.

The permits, when granted, will not include the right to conduct core or other exploratory drilling. Nor will a person given a permit hold any advantage in obtaining any oil and gas leases which may eventually be issued.

Interior has notified the Defense Department of its plans so that conflicts can be avoided over areas used by the military for gunnery ranges. It has also notified the governors of the states along the Atlantic coast of its action and is seeking their cooperation.

The secretary of interior's action was taken at the request of the Geological Survey, which said there are reasons to believe that the possibilities of finding oil increase in a seaward direction because of increased thickness in sedimentary formations in that direction.

Water depths are relatively shallow and exploratory drilling should be possible within an area up to 50 to 75 miles offshore, Geological Survey officials said.

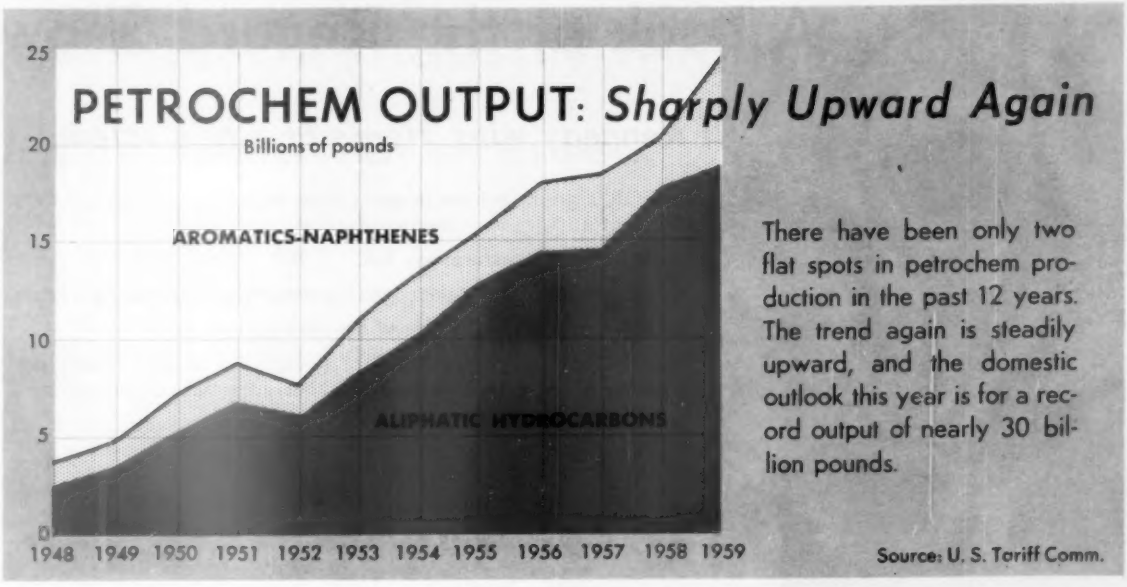
"In our opinion," the director of the agency said, "Interior should encourage exploration for oil and gas in this area."

Union Getting Ready To Push for 18-Cent Increase from Refiners

OCAW is already starting wage negotiations for a blanket 18-cent increase in the oil and petrochemical industry.

The union's District 4, covering Gulf Coast and Louisiana, will meet this week in Houston to discuss strategy. However, high policy will be set nationally by Knight out of Denver. Knight will decide when to set deadlines and whether they will fall on the same date for all companies or on different dates.

Elro Brown, regional OCAW director, says he understands the OCAW local for Texaco's Eagle Point, N. J., plant has taken a strike vote on local issues. Most Texaco plants are following Port Arthur's lead, although Long Beach, Lawrenceville, Ind., and Anacortes, Wash., have not yet signed, along with Eagle Point.


PETROCHEM OUTPUT: Sharply Upward Again
Billions of pounds
AROMATICS-NAPHTHENES
ALIPHATIC HYDROCARBONS
25
20
15
10
5
0
1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959
There have been only two flat spots in petrochem production in the past 12 years. The trend again is steadily upward, and the domestic outlook this year is for a record output of nearly 30 billion pounds.
Source: U. S. Tariff Comm.

Ethylene Remains No. 1 in Popularity

AFTER posting a healthy 16% increase in 1959, production of basic petrochemicals is expected to rise even higher this year with ethylene still leading the way.

This bright outlook is based on the latest study by the U. S. Tariff Commission. Its preliminary report shows the production of basic organic chemicals from petroleum and natural gas during 1959 was 24,277 million pounds compared to 20,903 million in 1958.

If this trend continues as expected, the production total should approach 30 billion pounds in 1960.

The report covers only petrochemicals destined for end use as organic chemicals. It does not include fractions going into synthetic ammonia, sulfur, carbon black, and other products.

Production by Major Products

(Thousands of pounds)

	1959	1958	1957
Aromatics and naphthenes			
Distillates and solvents	1,629,831	1,271,785	671,196
Benzene	1,530,423	1,041,659	851,628
Cresylic acid	37,888	38,078	35,191
Naphthenic acid	19,843	18,961	16,774
Toluene	1,817,095	1,501,337	1,121,585
Xylene	1,683,239	1,380,773	829,843
All others	31,508	32,341	43,278
Total	6,749,827	5,284,934	3,569,495
Aliphatic hydrocarbons			
C_2 hydrocarbons	5,644,902	4,795,322	4,586,161
C_3 hydrocarbons	5,488,679	5,035,744	4,249,571
C_4 hydrocarbons	4,698,230	4,294,619	4,573,550
C_5 hydrocarbons	100,452	171,524	141,518
All others	1,594,874	1,321,356	973,598
Total	17,527,137	15,618,565	14,524,398
GRAND TOTAL	**24,276,964**	**20,903,499**	**18,093,893**

Aliphatics . . . These big-volume products made up more than 70% of the basic petrochemical manufacture during 1959, with output of 17,527 million pounds (Table). This is a 12% increase over 1958.

Ethylene still retains the title of champion in petrochemical production, reaching a record of 4,954 million pounds last year, more than a 19% gain over the previous year.

Propylene is the next individual chemical in volume with 1959 production of 2,153 million pounds compared with an output of 1,769 million pounds for 1958. These figures do not include streams containing propane-propylene mixtures. Propylene production can be counted on to continue its rapid growth, particularly in light of the tremendous interest in polypropylene.

Butadiene also set a new record last year with production of 1,816 million pounds, a 25% increase over 1958. There is a new round of expansions under way in this rubber chemical which should push this gain even higher in the '60s.

Aromatics and naphthenes . . . With production of 6,750 million pounds last year, aromatic and naphthenic products racked up a 28% gain.

The largest volume product in this category was toluene, but benzene was by far the biggest percentage gainer with a 47% increase over 1958. Both toluene and xylene showed an increase of more than 20%.

These big gains in aromatics production underscore the increasing trend of installing aromatic extraction units in refineries.

A Look at the Record Shows

If Kennedy wins. Here's how he's voted:

- FOR a graduated **cut in percentage depletion,** but against a flat reduction to 15%.
- AGAINST a **natural-gas bill.**
- AGAINST legislation recognizing **state rights to submerged lands.**
- FOR an **increase in federal gasoline tax.**
- AGAINST a proposal to **bar foreign aid to any nation that expropriates U. S. owned property** without adequate compensation.
- FOR **"mild" restrictions on labor unions** but against new limits on picketing, secret ballot strike votes, tightening of secondary boycott bans.
- FOR increased **defense spending** and **foreign aid.**
- FOR **depressed-areas aid,** sewage plant grants, school-construction aid.
- AGAINST certain **"expense-account" tax deductions.**

Kennedy: Somewhat tougher sledding

THE OIL INDUSTRY will face somewhat tougher sledding in Washington if John F. Kennedy is elected president in November.

The Democratic nominee has not been openly hostile toward oil, and he will not launch a "crusade" against it. But he has voted against the industry on almost every oil and gas issue.

Because Kennedy has not taken an aggressive role in the past on oil matters, it seems safe to assume that he is not planning to do so if he becomes president. At least, not unless there is some major development to influence him one way or another.

What it adds up to, then, is this:

He is not likely to advocate a cut in percentage depletion, even though he once voted for a graduated reduction plan. But he wouldn't be likely to veto such action if it were taken by Congress.

He will probably keep silent on natural-gas legislation—even though he voted against the gas bill in 1956. If new legislation were passed during his term, he might not veto it, either, particularly if there were definite assurances that consumer interests were being protected.

He will probably advocate, as President Eisenhower has done, a continuation, or even an increase, in the federal gasoline tax.

The Johnson influence . . . One big deterrent against Kennedy's developing an active anti-oil program is the political fact of life that he will have Sen. Lyndon Johnson as his vice president.

Johnson surprised nearly everyone by accepting the No. 2 spot the day after Kennedy won his first-ballot nomination. He had insisted he would not "swap my vote for a gavel."

Kennedy realizes that his legislative program would have something less than its maximum chance of success without Johnson's cooperation.

Since they are of the same party, and since Kennedy is acutely aware of Johnson's influence in Congress, it is likely that Kennedy will seek to avoid any open split with Johnson.

The records of the two men show that they have voted alike on perhaps 90% of all issues they faced. The biggest single exception by far has been on oil-related legislation.

It appears logical, therefore, that Kennedy would not endanger Johnson's cooperation by making a major issue out of the narrow area where the two have disagreed in the past.

By the same token, Johnson is not likely to oppose the tendency of a Kennedy leadership to swing toward a more "liberal" approach to general domestic defense, and foreign problems.

Kennedy's general approach . . . There can be little doubt that Kennedy would be more inclined than the present administration to step up spending programs, broaden social-security programs, and to push for civil rights, housing legislation, and aid to education.

That is, the so-called "welfare" programs will get more emphasis.

Too, it is certain that if a recession should develop during a Kennedy administration, he would turn more quickly to pump-priming than Eisenhower was willing to do in 1957.

Kennedy has said publicly in recent days that he fears a sharp recession may occur next spring. And he implies that that administration's "tight money" policies are partly to blame.

Bear in mind that Kennedy no doubt feels that his selection as the Democratic nominee over more "conservative" candidates such as Johnson and Sen. Stuart Symington is an indication that the public favors his more liberal views.

Influence of public opinion . . . Naturally, the crystallization of public sentiment on any given major issue would sway Kennedy, just as it would virtually any president and Congress.

Kennedy, having been exposed to politics for 14 years, would certainly be responsive—perhaps much more so than President Eisenhower.

Fortunately, Kennedy has shown indications of being a reasonable, thoughtful man with a still-open mind.

For the oil industry and others, therefore, the challenge will be to develop broader public support and to make clear the need for sound approaches to the problems confronting the nation.

How the Oil Industry Might Fare . . .

If Nixon is elected. Here are his views:

- FOR continuation of **percentage depletion.**
- FOR a **natural-gas bill.**
- FOR recognizing **state rights to submerged lands.**
- FOR **easing tax burdens** on business and industry, including relaxing rules for depreciation write-offs, to stimulate the nation's economy.
- AGAINST "tough" bill of rights amendment to labor laws, but for Landrum-Griffin bill passed in 1959.
- FOR foreign aid, particularly to help friendly underdeveloped countries.

(Because, as vice president, Nixon was seldom called on to vote, his record is based primarily on public statements he has made on various issues. He is expected to express himself on more issues after—and if—he receives the nomination at the Republican convention.)

Nixon: About the same as Eisenhower

THE OIL INDUSTRY can expect about the same treatment from Vice President Richard Nixon, if he is elevated one notch to the presidency, that it has had from Dwight D. Eisenhower.

There are several indications that this is so.

First, Nixon, the apparent Republican nominee, will necessarily be slow to make any sharp break from the general pattern of the Eisenhower administration. After all, his campaign will have to be based in large part on the record of the current administration.

Such an approach will tend to bind him, at least in the early part of his administration, to the course that Republicans now in charge have already set.

There have been hints that Nixon will do things differently, and in some areas this no doubt will be true. But there is no cause to expect that this will occur on oil-related issues. If it happens at all, it will be in other areas.

Nixon has made public statements clearly indicating that his oil views are generally similar to those of Eisenhower. And the fact that he is from California may tend to give him a little more oil awareness.

Mild oil approval . . . What a Nixon administration would mean for oil, therefore, would likely be a mild resistance to any legislation which would affect the industry materially.

At the same time, the industry should not anticipate aggressive support from Nixon.

For instance, he favors continuation of percentage depletion, but he might not veto a percentage cut if it were included in a general tax package of which he approved.

And while Nixon has said that he favors a gas bill, it is a good bet that, like Eisenhower, he would not press actively for its passage.

Too, while he has indicated approval of oil import controls, he has also made it clear that he would question the wisdom of making any further substantial reductions.

What it amounts to, therefore, is that the industry could expect a reasonable attitude on oil in the White House, but it would be unwise to anticipate any major gains.

Nixon's general approach . . . It may well be that the greatest benefit the oil industry would get from a Nixon administration would result from Nixon's general attitude that a good business climate is necessary for the nation's economic welfare.

The Vice President has said, for example, that more liberal treatment of depreciation is needed to stimulate investments in plants and equipment.

He has said that there are good reasons to believe that a reduction in the 52% corporate tax rate would, in the long run, yield more revenue than it would lose because such a tax cut would stimulate business.

Although Nixon necessarily has subordinated his views to those of President Eisenhower, many Washington observers feel that Nixon has grown in stature and that he will develop an alert, aggressive program of his own as his administration—if he is nominated and elected—goes along.

These observers feel that Nixon's policies, generally, would be acceptable to most segments of business and industry.

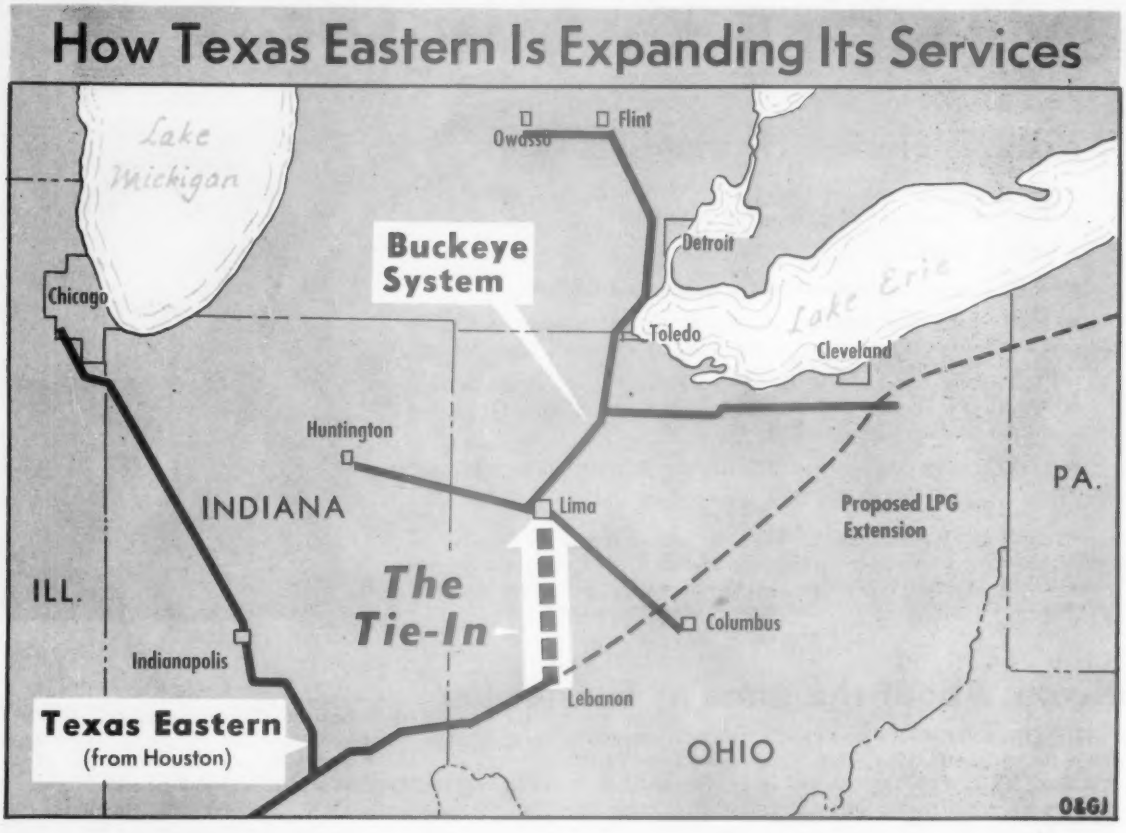
The political influence . . . Nixon, having had an active political career, probably would be more responsive to public opinion than President Eisenhower, with a military background.

This could be good or bad, depending on your view. It could mean, for example, that Nixon might play down his support for gas legislation if he felt the general public disapproved.

But, it could also mean that he would take an active role in support of such legislation if he became aware of rising public demand for some such action.

His general approach could also be influenced by future trends. If, for instance, the tide should swing for more "public welfare" type of programs, Nixon would probably move further in that direction than President Eisenhower.

Under this sort of Nixon approach, therefore, it would seem evident that the oil industry will need to tell its story and tell it well to the White House—and to the general public—during the years that Nixon may be in the White House.



Ohio Market Opening to Gulf Refiners

• Texas Eastern and Buckeye are tying their systems together with an 89-mile 10-in. link. It will give access to Ohio's growing, competitive market to refiners as far away as Houston. Also planned: A line to move LPG eastward.

Howard Wilson
Gulf Coast District Editor

THE FIGHT among major oil companies for the strategic Ohio market is entering a new phase.

Texas Eastern Transmission Corp. and Buckeye Pipe Line Co. soon will build a pipeline which will make the marketing battlefield accessible to still more major refiners.

It will be only an 89-mile, 10-in. line, but it will tie Texas Eastern's Gulf Coast product shippers into Buckeye's distribution system. It will, thereby, offer outlets in Michigan and Ohio to Gulf Coast marketers, and put them there on a competitive basis.

Although Texas Eastern has released no details, the deal with Buckeye was disclosed last April in a speech to the Natural Gasoline Association of America by Millard K. Neptune, senior vice president of Texas Eastern (OGJ, May 2, p. 84). Details of the services are contained in brochures made available to potential customers.

Texas Eastern and Buckeye—going 50-50—will construct the line from the Little Big Inch's northern terminus at Lebanon, in southwestern Ohio, to Buckeye's 490-mile products system at Lima, Ohio (map).

This will open up Cleveland to the east; Toledo, Detroit, Flint, and Owasso to the north; Huntington, Ind., to the west; and Columbus in central Ohio. Though the Buckeye system extends on into Pennsylvania, Texas Eastern won't make use of this section because the Little Big Inch's competitive position for motor fuels deteriorates beyond Cleveland.

The market . . . Ohio is a market of prime importance.

It has been growing at an annual rate of 4% to 5% for motor fuel and distillate fuel oil, and it should grow at least another 25% to 30% in the coming decade. As the hub of an east-west network of superhighways now under construction, it is one of the nation's fastest growing markets.

Some 60% of this market is supplied today by five companies which have their own refineries and pipeline distribution systems in the area. Sohio, with three refineries, is the big gun with nearly 30% of the market. The other four, owning six refineries among them, are Sun, Gulf, Pure, and Ashland.

Other competitors, such as Shell, Sinclair, and Texaco, have controlled pipeline outlets, but there are many smaller marketers who lack refineries and controlled pipelines. And these are ripe prospects for the oil companies who can deliver products

from Gulf Coast refineries over the Little Big Inch.

In addition there are such giants as Humble and Phillips who expect shortly to invade Ohio and will be looking for ways to move in their products competitively. These certainly will be prime targets for the Texas Eastern sales pitch.

The competition . . . Aside from the refineries directly in the marketing area, products move into northern Ohio principally via barge from the south and through the new 12 to 24-in. Laurel products line, owned by Gulf, Texaco, and Sinclair.

Buckeye also is a source of products from the Chicago refining area.

Laurel, which extends from the Philadelphia refining area to Cleveland, will be a natural competitor of Texas Eastern and Buckeye at Cleveland, where East and West truly meet.

Texas Eastern will compete quite favorably with river barge rates, which vary widely and usually are higher than the rates the Little Big Inch will offer via the new extension and Buckeye.

One incentive Texas Eastern plans to offer is a choice of shipment by custom batch or in common stream. Those shipping motor fuel by custom batch—the system now in use to the Lebanon terminal—must provide their own storage tanks.

Those shipping by common stream will have tankage provided, and they can supply their additive at the terminal or when loaded on tank trucks.

Texas Eastern believes the new business generated by the Lima extension should add some 6,000 bbl. daily to its throughput within 6 months and some 25,000 bbl. daily within 2 or 3 years.

This will be important new business because the line has far greater capacity than it is now using.

Capacity for the 20-in. line is 180,000 bbl. daily. Since the 14-in. Chicago lateral has only a 90,000-bbl. capacity, Texas Eastern is eager to develop its markets eastward.

The new line . . . The Lima-to-Lebanon extension job will be handled administratively by Buckeye.

Construction contracts will be let shortly, and completion is set for mid-autumn.

Texas Eastern will supervise construction of a pump station at Lebanon and then operate it subject to Buckeye's dispatching schedule.

What's ahead . . . The road ahead may be more intriguing than the immediate Texas Eastern goals.

Before going into the Buckeye deal, Texas Eastern directors had authorized construction of a line directly northeast to Cleveland from the Lebanon terminus. This was to be another leg in the Little Big Inch system which eventually would extend into western New York near Elmira.

This plan, despite the tie-in with Buckeye, is still in the works. Right-of-way for a 200-mile 10-in. line between Lebanon and Brecksville, on Cleveland's outskirts, has been largely purchased, and chances are good that some day the line will be built. Whether it will be another joint venture with Buckeye or a solo jaunt by Texas Eastern is still unsettled.

Still another project, and perhaps more imminent, is the construction of underground storage in the Cleveland area for LP gases and petrochemical feedstocks.

Certain that the market is there, Texas Eastern wants to start out with about three 100,000-bbl. jugs leached out of salt beds. The problem is to convince local health and natural resources authorities that underground storage is not a hazard.

Basically, however, Texas Eastern expects to have underground storage at Cleveland eventually, possibly within 2 years. This project is not necessarily dependent on construction of the Lebanon-Brecksville line.

And on east . . . Texas Eastern figures that Cleveland is the farthest east it can expect to move motor fuels and burning oil competitively from the Southwest. But propane is another matter.

The extension of pipeline service for propane to Cleveland should make possible a saving of about 1 cent per gallon over current rail rates in the transportation cost from the Gulf Coast to New York and New England.

Texas Eastern, therefore, hopes first to develop a propane market to Cleveland by the Little Big Inch and then eastward by rail or truck. When sufficient volumes are developed, it would then extend the Little Big Inch itself into the State of New York. From that point all of New England would be at its doorstep.

Texas Eastern expects this move to help, rather than hurt, the eastern refiners in marketing their propane.

Underground storage for propane in New York would make it possible to furnish year-round service that eastern refiners find hard to handle. Unlimited supplies of propane are available from the producing areas of the Southwest, while refineries are limited in their output.

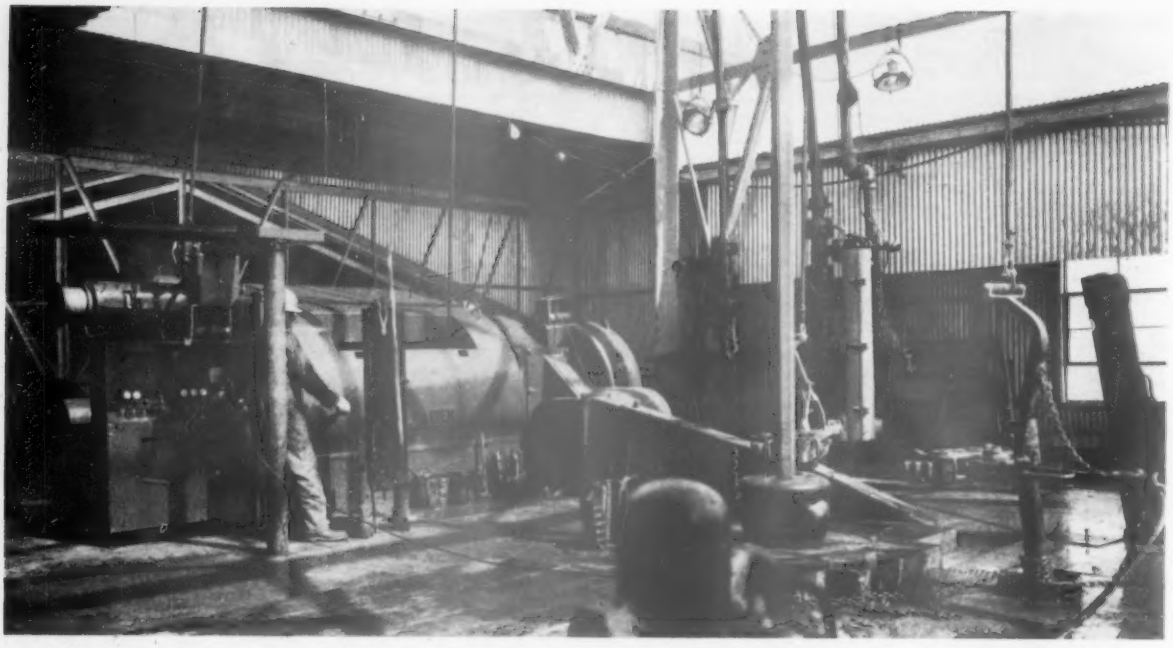
The certainty of year-round supply should result in more conversion to propane as a fuel, give eastern refiners more warm-weather outlets, and provide healthy new business for Texas Eastern.

Meanwhile, Texas Eastern is not waiting for underground storage at Cleveland before moving propane eastward. It is now able to move propane by tank car and truck out of the Todhunter terminal near Lebanon. The volume depends on the severity of the winter.

Whatever the opportunities, Texas Eastern today is moving to grab them. Convinced that its decision to reconvert the World War II line to products was sound, the company has been building its throughput with successive deals that point to real profits in the future.

Ohio's Marketers

Company	% of Market	Refineries in Ohio area	Capacity (Bbl. Daily)
Sohio	29.7	3	123,000
Sun	10.2	1	95,000
Gulf	9.2	2	74,000
Pure	7.5	2	56,000
Shell	7.4	...	...
Sinclair	5.2	...	...
Texaco	4.2	...	...
Ohio Oil	3.9	...	...
Ashland	3.7	1	28,000
Mobil	3.5	...	...
Cities Service	3.4	...	...
American Oil	2.1	...	...
Atlantic	1.7	...	...
Independents	8.3	...	...



DRILLIING FLOOR where crews added a joint every 2 minutes while operating at top speed.

Gulf Shows How to Drill a Mile a Day

• Record-breaking drilling speed is Gulf's answer to higher costs, and it's no fluke. This 5,142-ft. record, more than 5,000 ft. of it with one bit, merely caps a long string of examples which point to even faster drilling.

Ed McGhee
Drilling Editor

GULF OIL CORP. has polished to even brighter luster the drilling crown it already had created for itself out of the muck of South Louisiana's Timbalier Bay.

In its latest Herculean effort, Gulf and its drilling contractor made more feet of new hole in one day than anyone else ever before. In a single 24-hour period this month, a crew raced through 5,412 ft. of hole. An almost unbelievable 5,114 ft. of this was on a single bit.

In reflecting on the unprecedented speed, Gulf men praise the contractor, Dixie Drilling Co. whose barge Rig 3 was on the State Lease PP No. 158. No doubt, the record effort got off to a running start because of Rig 3's mammoth hoisting and pumping plant.

Still, the final payoff hinged on drilling practices which Gulf engineers prescribed down to the last pound of weight on bit, rotary speed, and hydraulic pressure.

Bold departure . . . The strategy planned in advance by Gulf is bold in its departure from usual practice and extreme in its values.

The 9⅞-in. bit whirled at 225 r.p.m.; weight was a hefty 60,000 lb.; and jet velocity reached a bottom-blasting 510 ft. per second. A crucial factor in the record run was Rig 3's biggest ever 2,000-hp. pump which ran against 3,500 psi. to circulate 620 g.p.m. for an annular velocity of 220 ft. per second.

Gulf's mile-a-day pace is drilling's equivalent to Roger Bannister's 4-minute mile. The difference is that Gulf is setting records in the dashes as well as in the distances. During the past 6 months, the company working in the same area has successively set and broken new records for drilling to 10,000 ft. (OGJ, Jan. 11, p. 44).

Latest time to the 10,000 ft. tape was 4 days and 17 hours from spud. Gulf men are confident they'll soon clock an even better time in this event.

No one who has watched the Timbalier Bay sprints is inclined to pooh-pooh Gulf's accomplishments nor its expectations for even faster records. True, some say, drilling in the soft sediments of this area is somewhat like running with the wind to your back. Still, others have drilled identical situations in the area at what, in comparison, might be called a walking pace. Gulf's engineers capitalized on drilling science available to everyone, added some imagination and experimentation of their own, and came up with a winner by a mile-a-day.

Concerted program . . . Costly as overwater drilling is, Gulf obviously isn't muddying up Timbalier's waters simply to set records.

The firm is developing its oil reserves in the area in the cheapest way it can. And, as is most often the case, the fastest drilling has proved by far the cheapest.

The company has been drilling almost continuously in the Timbalier area for several years. Actually, the activity has been centered in two fields, one in the shallow waters of Timbalier itself and another in the deep waters 30 miles offshore in the "South Timbalier" area. Since Suez, Gulf has found itself in that familiar-to-all situation where skidding allowables threaten to make further drilling uneconomic.

HEAVY RIG has powerful mud pumps.

Over Water

That's why Gulf elected to conduct an all out campaign on drilling costs. As each new well was drilled, any promising new idea was tried. The good were kept and used again; the unsuccessful were discarded. After months of such experimentation, during which Gulf men sat on the rigs directing operations and observing results, the pattern of best—or near best—operating practices began to emerge.

During this period of evolution, Gulf brought in some of the biggest and most modern marine rigs available. In the far offshore area, Kerr-McGee's big Rig 46, turned in record footage; Reading & Bates 3-legged monster, the C. E. Thornton, drilled several wells. In the bay waters, a Rowan Drilling Co. barge rig set the still-standing record to 10,000 ft. Dixie Drilling moved into the field June 1 and on its first well set a record of 5,140 ft. in a single day. And, now, even that record has been blasted.

Under surface pipe . . . The record 5,412-ft. drilled in a single day was the interval between 2,043 ft. and 7,455 ft.

This span includes 5,114 ft. made in 16 hours by the first 9⅞-in. bit to drill out from under the surface pipe. The remaining 298 ft. was made in the few minutes left in the day after a trip had been made to change bits.

Drilling and casing the surface hole went also fast though the time has been equalled in other Gulf Timbalier wells. The hole was spudded through a conductor string of drive pipe. Hole was made by a 12¼-in. bit with an underreamer which increased final hole diameter to 15-in. The 2,043 ft. of surface hole was drilled in only 4 hours.

Then, 10¾-in. surface pipe was run and cemented to the 2,043-ft. mark. Shortly after the cementing plug landed, the 9⅞-in. bit was run and drilling resumed. Total elapsed time from the cement where the 12¼-in. bit started off bottom till the 9⅞-in. bit began drilling: 12 hours.

Much of the speed in resuming drilling after running the surface string is due to a Gulf-devised rigup for blowout preventers on the 10¾-in. casinghead. The preassembled preventer stack can be slipped on the wellhead and secured with a minimum of lost time and motion.

Drill string in the 9⅞-in. string included twenty-one 7½-in. drill collars. These were used to apply as much as 60,000 lb. of weight to the bit; drillers in many hard-rock areas would consider this "high" weight. Many drillers in South Louisiana consider it "astronomical."

The string was turned up to 225 r.p.m., a speed almost unheard of in any drilling east of the Rocky Mountains. In using such fast speeds, Gulf engineers say they are flying in the face of advice from sound engineering sources. In many areas, hard-rock regions at any rate, moderate rotary speeds (less than 100 r.p.m.) have proved to get longest life from bits. Gulf men say their experience is the opposite; the higher the rotary speed, the more feet each bit drills. Bit life in hours is shorter at higher speeds, they say, but bit footage is longer.

It's obvious from their speed that the Dixie Drilling crews didn't dally in making connections. In fact, adding new singles to the string was an almost continuous task. It took only 30 to 40 seconds to drill the kelly down, and the new hole was not reamed with the bit as is often customary. Then, it took only 1¼ to 1½-minutes to add a new single and resume drilling.

Gulf's engineers have studied using a power swivel so that they could drill down 90-ft. stands instead of 30-ft. singles. Such a scheme was tried; and while they haven't given up the idea, Gulf men say they find conventional drilling with kelly and rotary table superior at present.

Suction on the bay . . . Where Dixie Drilling's Rig 3 really got to show its stuff was on the hydraulics program.

The rig has the most powerful—or near to it—mud pumping plant ever assembled. Its two main pumps are rated at 2,000-hp. each. These are Bethlehem B-1640 forged-end pumps. In addition, there is an independently powered Bethlehem H-25 pump for mud mixing.

Driving the big pumps are three Waukesha turbo-charged diesels, each rated at 1,100 hp. These mammoth engines are mechanically compounded to drive rotary, draw works, and pumps.

On the surface hole, both pumps operated in parallel at relatively low pressure but at extremely high circulating rates. In the 9⅞-in. hole, only one of the big pumps was used; it ran at 80 strokes per minute against 3,500 psi. in 6½-in. liners.

The 620 g.p.m. of mud displaced by the single pump created velocities of 510 ft. per second through the bit's 13/32-in. jets. Rising velocity in the annulus around the 4½-in. drill pipe was calculated at 220 ft. per second. Without doubt, this great blast of mud could have drilled the hole at modest rates even though the rotary were not turned.

It's a little difficult to grasp how much a mile per day of 9⅞-in. hole means in terms of the amount of rock removed from the earth. To visualize it, consider that Rig 3's pumps were taking suction on the bay. Bay water weighs roughly 8 lb. per gallon. When the hole was drilling at its fastest (above 400 to 500 ft. per hour), the fluid coming back out of the hole weighed 10 lb. per gallon and more.

That is, in one circulation through the well, the fluid picked up 2 lb. per gallon in formation solids. The pumps were circulating more than 600 gal. per minute. As much as 1,200 lb. of rock was removed from the well every minute.

Trouble came later . . . Wrestling drilling records from Timbalier's rocks has not been without grief. Shortly after the record 5,412-ft. run the 158 state lease was hauled up short with a fishing job. When the second 9⅞-in. bit had been in the hole only 3 hours the drill string torqued up while drilling ahead and failure followed.

Cause of the failure is uncertain but much evidence points to the possibility that torquing resulted from cones running off the bit. If so, Gulf men consider it a once-in-a-million fluke which reflects no discredit of their drilling practices nor the contractor's equipment.

After several days most of the fish had been recovered and the hole was bottomed out just below 10,000 ft.

New Rubber Combine Formed

. . . to produce both polyisoprene and polybutadiene. It will build the seventh synthetic "natural" rubber plant.

COMPETITION is getting hotter in synthetic "natural" rubber with a new company attracted to the field.

The new firm, set up to produce both polyisoprene and polybutadiene, has been formed as a joint venture by Stauffer Chemical Co. and American Synthetic Rubber Co.

It will be known as American Rubber & Chemical Co. and will build a multimillion-dollar plant adjacent to American Synthetic Rubber in Louisville, Ky. A process licensed from Phillips Petroleum Co. will be used.

Initial plant capacity will be 30,000 long tons per year with allowances for expansion up to 50,000 tons. The new facilities are expected to go on stream in September, 1961.

American Synthetic will manage production and marketing for the new plant while Stauffer will be responsible for construction. Both companies will staff the pilot plant and research labs.

This new enterprise will bring the total of synthetic "natural" rubber plants planned or under construction to seven. Four of these are the combination polyisoprene - polybutadiene type, two mainly for polyisoprene production and one for manufacturer of polybutadiene.

A rundown on these projects looks like this:

. . . **Polyisoprene.** Shell Chemical Co. is building a 20,000 long ton per year plant for making polyisoprene at Torrance, Calif. that is scheduled to be complete late this year.

Also, it has been announced that a plant twice this size will be built somewhere in the Midwest (OGJ, May 16, 1960, p. 99).

. . . **Polybutadiene.** Phillips Chemical Co. is expanding its semicommercial works at Borger, Tex. to 20,000 tons per year.

. . . **Polyisoprene-polybutadiene.** The American Rubber and Chemical Co. facilities are the latest entry.

Firestone Tire & Rubber Co., however, plans to complete a 30,000-ton plant at Orange, Texas, this year. Initial production will be polybutadiene.

Goodrich-Gulf Chemical has announced plans for a plant to be built at either Orange, Tex., or Institute, W. Va., with a capacity of 25,000 tons per year. This plant is expected to be in operation sometime in 1961.

Goodyear Tire & Rubber Co. should have its 25,000-ton plant near Beaumont, Tex., on stream around the middle of next year.

While both of these synthetic rubbers are commonly called synthetic "natural" rubbers, polybutadiene is better suited as an extender for natural rubber rather than a complete substitute. Used as an extender, polybutadiene greatly increases resistance to heat and abrasion and is therefore prime material for the production of truck tires.

Polyisoprene is chemically identical to natural rubber and is expected to replace the natural product in many uses, particularly as the demand for rubber increases beyond the capacity of the natural sources to produce.

Key Decision Made

. . . by FPC granting 6.5% return to Southern Natural.

A RECENT decision by the Federal Power Commission gives some indication of the direction the commission may be heading on natural-gas regulatory matters.

In a ruling involving Southern Natural Gas Co., FPC granted the company a rate of return of 6.5% on its pipeline properties. This was the second time in recent years that it has granted that high a rate.

FPC also granted a 7% rate on the company's producing properties, but this is a tentative figure, pending an FPC decision on application of tax benefits for depletion and intangible drilling costs.

The case was also important in that it marked an FPC decision on another controversial issue: Interim orders.

In an effort to speed up disposition of rate cases. FPC has ruled that hearing examiners may decide initially solely upon a rate of return without waiting to settle all the other issues of the case.

In the Southern Natural decision, the commission upheld this approach.

PROCESSING BRIEFS . . .

Celanese Corp. of America is doubling capacity of its Pampa, Tex., plant for production of higher acrylate esters. The new facilities, to be completed this year, will be capable of producing 14 million pounds of 2-ethylhexyl acrylate, butyl acrylate, and glacial acrylic acid.

Maleic and phthalic anhydride waste product streams can be profitably converted to fumaric acid using a new process announced last week by Scientific Design Co., Inc. The company says plants using this process can be operated economically on production as low as 3 tons per day.

A $300,000 improvement of Continental Oil Co.'s KMA natural-gasoline plant near Electra, Tex., has been completed. The project includes replacement of an outdated absorption oil unit with a refrigeration-type natural gasoline processing plant.

The site picked for AviSun Corp.'s 100 million pound per year polypropylene plant is New Castle, Del. The new plant will be adjacent to the company's 10 million-pound-plant. Bechtel Corp. has the engineering contract for the new plant.

A waste-heat recovery plant will be built at the Whiting refinery of Standard Oil Co. (Ind.). The new unit is being added to an expanded fluid catalytic cracking plant. The refinery mechanical division will construct the new plant. It is scheduled for completion in the spring of 1961.

Also for Refiners . . .

IN THE NEWS: LPG salt-cavern storage suit may be settled out of court (p. 60) . . . Unions getting ready to press for 18-cent increase (p. 60) . . . Output of basic petrochemicals will come close to 30 billion pounds this year (p. 61) . . . Gulf Coast refiners will have access to Ohio market through Texas Eastern's Little Big Inch as a result of joint project with Buckeye (p. 64) . . . Billups tells how it makes a good profit on gasoline (p. 70) . . .

PLUS THESE TECHNICAL REPORTS: How to measure tube-wall temperature (p. 100) . . . New slide valve is compact and versatile (p. 106).

from drawing board to installation . . .

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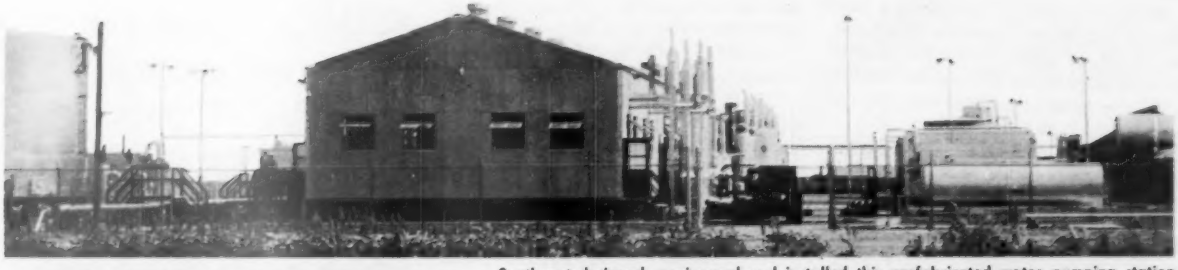
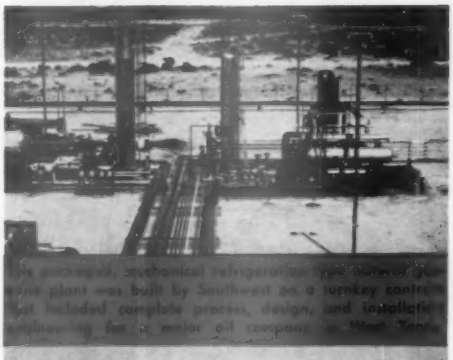


Southwest designed, engineered and installed this prefabricated water pumping station for a Pan American Petroleum Corporation unitized water-flooding operation in Southwest Texas.



Southwest incorporates engineered, pre-fabricated methods to install unitized facilities — *quicker and cheaper* — for the oil, gas and chemical industries on a turnkey basis. All are API-ASME code constructed.

Southwest's competent staff of mechanical, chemical and civil engineers—all registered as professional engineers with years of experience in this type work—can complete your project months ahead of field-constructed plants. Complete flexibility also enables Southwest to construct to your engineering requirements or to offer custom-designed plants FOB our shops for installation by others.

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Says Billups: Gasoline Can Be Profitable

• There's a simple formula, says this big private-brand company: Cut prices and outpromote everybody else. For Billups, at least, it's successful.

GASOLINE can be marketed at a handsome profit. Proof that it can be done was given to the New York Security Analysts last week by W. H. Montjoy, who told them how the Billups Petroleum companies do just that.

Billups, probably the nation's largest private-brand gasoline marketer, has a rather simple formula: Undersell and outpromote the regular brands.

Billups generally undersells regular brands by 2 cents a gallon. This is more or less its regular policy; but when a severe price war is on, this margin may be cut to 1 cent.

Billups aggressively promotes its slogan, "Fill up with Billups—your friend." When it opens a new station, it may sell regular for as little as 22 cents a gallon for the first few days, provide gifts for children and adults, decorate the site extravagantly, have balloons flying overhead and searchlights scanning the skies.

The searchlights are only good at night, of course, but this is one Billups plus. Its stations are open 24 hours. Only a few of its stations have doors because, as Montjoy put it, they're never closed.

Billups stations have another distinction—none has chairs. "Our men at the stations are paid almost 100% through the incentive plan," Montjoy, vice president and secretary of Billups Western and secretary of Billups Eastern, said. "They get a part of every dollar that goes through the cash register. They feel that the station is their business and, practically, that's the truth of it."

Big volume . . . The average Billups station does 40,000 gal. a month—two and a half times the national average of 16,000 gal.

Many companies have approached Billups with an offer to buy. "We listen politely," Montjoy said, "and that's the end of the conversation." Billups has a good thing and doesn't intend to let go of it.

Here's just how good it is:

Billups Eastern in the 12 months ended June 30, 1959, paid stockholders a dividend of 42½ cents per share, equal to 8½% on the price of the stock. It expects to do at least as well this year despite an unusually bad winter.

Billups Western ended its first fiscal year April 30, 1960, and paid its common stockholders dividends equal to slightly more than 8% and its debenture holders 7.33%.

Billups Eastern built a new office and warehouse in Jacksonville, Fla., and Billups Western added $583,630 in fixed assets in the past year. Over and above these outlays Eastern added $220,784 in 9 months and Western $468,411 in 12 months in working capital.

"Both organizations are well equipped to continue their expansion programs without impairing their working capital, and this is what both intend to do," Montjoy said.

He said that the rumor Billups intends to go into California was without foundation. R. H. Peyton, president of Billups Eastern, said that they will "in time" move into the New York area. Before that, however, Billups Eastern will consolidate its position in the South where year round sales opportunities are better.

Innovations . . . Billups has cashed in on two marketing innovations:

A new station design and a policy of stocking nearly anything that will sell.

Billups' first "mirror" station was opened in 1946. It had a solid glass front with display shelves in a stair-step pattern inside backed by mirrors. This new departure in station design had an immediate and tremendous public acceptance.

This display plus sales of "anything and everything—watermelons, sugar cane, bobbing birds, hula hoops, coon tails, dolls, cigarettes, panda bears, tricycles, bicycles, shrubs, plants or anything we thought might catch the public fancy" paid off.

"These other sales provide a cushion in periods of depressed prices and make us able to weather gas wars better than competing companies," Montjoy said. "Our policy is and will be to build these other sales to an even greater volume, for we are convinced that plastic toys and other items not only offer opportunities for profit but also act as a magnet for gasoline customers which we are not deemphasizing or overlooking as our bread and butter."

Neither company gives trading stamps or goes out on a limb on credit. Western's credit sales amount to 6% and Eastern's even less.

Delhi-Taylor, which recently bought a 35% interest in Billups Eastern, is that company's principal gasoline supplier. Eastern recently signed a new contract with Delhi-Taylor at ⅜ cent per gallon below its previous contract. Signal, formerly Eastern States, is Billups Western's main supplier.

ASTM D-2 Committee Suggests Changes in No. 2 Fuel-Oil Specs

MORE exacting specifications for No. 2 fuel oil which would lead to a more standard fuel and enhance burner design are being considered by ASTM Committee D-2.

Existing specs D 396 have been unchanged since 1948. These are the proposed changes as recommended by committee D-2:

. . . **To require** a minimum viscosity of 2.0 centistokes in the No. 2 oil specifications.

. . . **To reduce** the maximum viscosity of No. 2 oil from 4.3 to 3.6 centistokes.

. . . **To raise** the minimum gravity from 26° API to 30° API.

. . . **To reduce** the maximum 90% distillation temperature from the pres-

PIPELINE

Purchase of the Oil Basin Pipeline Co. products line from Billings to Glendive, Mont., has been made by Farmers Union Central Exchange, which has a refinery at Billings. Farmers Union has started construction on a 190-mile 8-in. extension of the line from Glendive, Mont., to Minot, N. D. The 15,000-bbl. daily system will be operated by Cenex Pipeline Co., St. Paul, a subsidiary of Farmers Union.

A 47-mile 24-in. gas line will be built by Transok Pipe Line Co., Tulsa, from a point on Transok's line in Creek County to the new power plant of Public Service Co., Tulsa, at Oologah, Okla. Construction will begin next month.

Contract for an 18-mile 20-in. line for Transcontinental Gas Pipe Line Corp. in Delaware County, Pennsyl-

ent 675° F. to 640° F. and add a minimum 90% distillation temperature of 540° F.

... **To add** a footnote to the specifications setting the minimum viscosity at 1.8 centistokes and waiving the 90% point when pour point less than 0° F. is required.

... **To delete** from the No. 1 oil specifications the present 625° F. maximum end point and add a 550° F. maximum 90% point.

These changes would sharpen the delineation between No. 1 and No. 2 fuel oils and would narrow the range of acceptable fuels for the No. 2 grade. They will be considered by the committee and, if approved, will be recommended to the ASTM. Both D-2 and ASTM must approve the changes before they can be adopted.

W. T. Gunn, secretary of the committee, is taking comments on the proposed revisions.

Nova Scotia Hunt Started

TWO VESSELS have left Halifax to start a hunt for oil off the southwestern Nova Scotia coast.

The vessels have been engaged by Mobil Oil of Canada, Ltd., of Calgary. The ships will conduct a 5-week marine seismic survey to map possible undersea structures favorable to the accumulation of oil and natural gas in the Sable Island area.

A. H. Giesbretch, Mobil representative, Halifax, said that if favorable indications are found in this survey drilling would start next summer.

Canada to Take New Look at Oil Markets

A STUDY of Canadian oil marketing will be a "priority task" of the government as soon as the current session of Parliament ends, Trade Minister Churchill told Commons.

He was asked whether the government is in a position yet to make a declaration on oil marketing in connection with the second report of the Borden energy commission.

The report recommended that the federal government give the international oil industry about 18 months to find room in North American markets for Canadian crude or face possible import restrictions.

On that basis, the report turned down proposals for government action at the present time designed to bring about construction of an oil pipeline from Alberta to Montreal.

Following the session, Churchill said, the question of crude-oil marketing will become "a priority task insofar as I and my colleagues and my department are concerned."

The government would ask the National Energy Board to prepare material to aid the study.

Churchill said the government is "fully aware" of the marketing problem and will review all suggestions.

Pan Am Plans Big Miscible Drive Project

PAN AMERICAN Petroleum Corp. will soon start injection in a miscible drive in Midland Farms Wolfcamp reservoir in West Texas which it feels will about double the oil take it could get from a water flood.

Pan Am figures the project as planned will hike total recovery about 9,000,000 bbl. over primary and about 4,100,000 bbl. above what it could recover with a straight water flood.

Using a peripheral pattern, Pan Am plans first to inject 320,000 bbl. of LPG together with 500,000,000 cu. ft. of gas, then 500,000,000 cu. ft. of dry gas, and finally an undisclosed amount of water.

The same four input wells, the company's Midland Farms 6, 9, 15, and 19, will be used to inject all fluids into the 8,400 ft. Wolfcamp pay.

The project will affect 1,600 acres of the field's 3,680 acres, on which there now are 21 producing wells.

LPG will come from Tuloma Gas Products Co., the gas from the Midland Farms gasoline plant, and water from the shallow Santa Rosa formation.

Operator will inject the enriched and dry gas at a rate of about 750,000 cu. ft. a day per well at 2,000 to 3,000 psi. at the well head. Later the wells will switch to injecting water at an initial rate of 650 bbl. daily per well and under 1,000 psi. pressure.

BRIEFS . . .

vania, and Gloucester County, New Jersey, has been awarded to Fulghum Contracting Corp., Harrisburgh, Pa.

Deliveries of crude will drop to 91,000 bbl. daily through Trans Mountain Oil Pipe Line Co. this month. Reduction in deliveries through the 30-in. line from Edmonton into Washington is due to maintenance shutdowns of two British Columbia refineries.

A 36-mile jet-fuel pipeline will be built from Artesia, N. M., to Walker Air Force Base near Roswell, N. M., by Aztec Pipe Line Co.

Rate reductions for crude-oil shipments are planned by Interprovincial Pipe Line Co. November 1. The company said rates would be cut from 1 to 7 cents a barrel, with new rates being 20 cents from Edmonton to Regina, 37 cents to Superior, Wis., 50 cents to Sarnia, Ont., and 54 cents to Toronto. Interprovincial will reduce the added charge it is making on Midale-type crude to 5% from 10% and on Fosterton-type crude to 15% from 25%.

Some 53 miles of 24-in. and 30-in. gas line will be laid by Central Illinois Light Co. in Peoria, Tazewell, and Marshall counties, Illinois. Contract has been awarded to Somerville-Illinois Co. Construction got under way last week.

Three products lines involving Continental Oil Co. and affiliates are being built this summer. Contract to lay an 85-mile 6-in. products line from the Yellowstone Pipe Line Co. system at Helena to Great Falls, Mont., has been awarded to R. H. Fulton & Co., Lubbock, Tex. The line is being built by Continental and Husky Oil Co., two of the Yellowstone owners.

Also for Pipeliners . . .

IN THE NEWS: Four pipeline systems are proposed for moving Alberta's coming glut of gas liquids, but the question remains: Who'll buy the surplus? (p. 57) . . . Texas Eastern teaming up with Buckeye to open Ohio marketing area to Gulf Coast refiners (p. 64).

PLUS THESE TECHNICAL REPORTS: New variable-diameter pipeline scraper saves $200,000 (p. 94) . . . Black box determines jet-fuel cleanliness (p. 121).

Good Gas Well Hit in California

- **An offset in Grimes field tests far better than the discovery well. Its flow comes from six new zones.**

CALIFORNIA'S best gas well in months tested 33 million cubic feet of gas from six zones last week.

In much of the oil patch, a 33-million-foot gas well isn't much to crow about, but in California it is an excellent well. In the first place, you're looking at a wellhead price of about 30 cents—and prices like this make even a million-foot well worth while.

Cameron Oil Co., Los Angeles, and Franco Western Oil Co., Bakersfield, are preparing to complete at 8,500 ft. The well, Helen McLaughlin 1, is a northeast offset of the discovery well in Grimes field, Sutter County. The McLaughlin 1 is in 5-14n-1e, about 50 miles northwest of Sacramento.

The discovery flowed on an open-flow test at the rate of 9,200 M.c.f. daily through 2-in. tubing from a 40-ft. sand at 6,552-92 ft. But the offset looks like a much better well.

The six zones tested are all deeper than the producing sand in the discovery well. The most shallow zone in the offset is a 39-ft. zone between 6,920-59 ft. It tested 6,500 M.c.f. daily through a ⅜-in. choke. The highest flow in the offset is from a 140-ft. zone between 7,189-7,329 ft. which flowed 7,920 ft. However, a 43-ft. zone between 6,962-7,005 ft. flowed 7,250 M.c.f. daily through a ⅜-in. choke.

In the six zones tested so far, the operator has found 594 ft. of pay.

The play . . . The McLaughlin well is located in the heart of the Sacramento Valley gas play.

Increased drilling for gas in the Sacramento has helped offset the drop in oil exploration in much of the rest of California.

Low drilling costs coupled with the high field price for gas has attracted many independents to the gas play. In fact, many are unable to stand the high costs of drilling for oil in California and are concentrating on gas exploration in the Sacramento.

Slim-hole rigs are used on most of the holes and it is not uncommon to make 6,500 ft. of hole within 10 days. Most of the gas is from shallow zones, with the Cameron-Franco Western well going deeper than most with its projected depth of 8,500 ft.

Smog-Rule Hearing

. . . scheduled in August by Los Angeles board.

A DRIVE has been started to revise Los Angeles County's Rule 62, the smog law which bans the burning of fuel oil of more than 0.5% sulfur content from May through October.

Western Oil and Gas Association is urging the county to take a close look at the smog law with an eye on restoring "free competition" between fuels. The association wants to put the county back on a two-fuel economy the year around. Right now, industry switches from fuel oil to natural gas 6 months out of the year and any other time when smoggy weather is forecast.

The pitch the association is making is to revise Rule 62 to permit burning a combination of fuels which does not exceed 0.5% sulfur content. And the association wants the rule extended throughout the year rather than limited to 6 months.

Howard G. Vesper, association president, said WOGA has made studies of how Rule 62 complies with air-purity standards adopted by the state department of health December 4, 1959. He wants to present the results of these studies to the county in an effort to revise the rule.

The county's board of supervisors has set a preliminary hearing for WOGA's request for August 9. Both the industry and the Air Pollution Control District, the smog-enforcement agency, will appear at the August hearing.

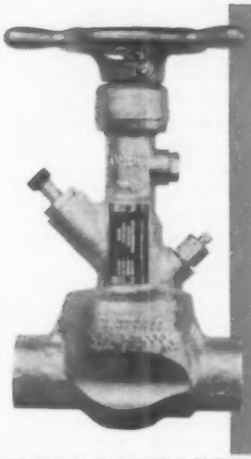
Water Detector Developed

SOCONY Mobil Oil Co. has a fluid density logging tool which uses nuclear radiation to find where water is getting into oil wells.

The logging tool can be lowered into a well. It uses low energy gamma rays to detect a difference in fluid density opposite the water-producing formation. This difference is transmitted to the surface, allowing the operator to seal off the water zones with cement.

THEY'RE NEW for dual and triple completions

ORBIT'S 1 1/4" RECESSED FULL ROUND OPENING SCREW END PRODUCTION VALVES

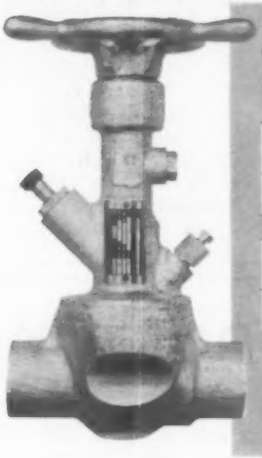


DUAL RECESSED
Fig. No. 4643D
10 Round Thread Upset

6,000 Lbs. TEST
3,000 Lbs. W. P.

SIZE	FIGURE NUMBER	TEST PRESSURE	W.O.G.	A	B	C	D
1¼"	4643D	6,000	3,000	1⅜	8	12⅞	1 15/16

E	F	G	H	J	K	M	NO. TURNS TO OPEN	WEIGHT
9½	1 13/16	1½	—	—	—	2 11/32	10	29 Lbs.

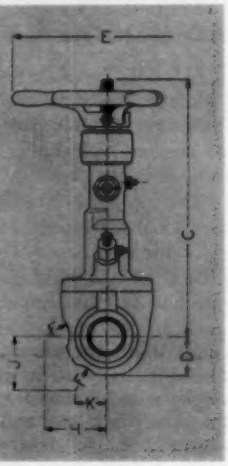


TRIPLE RECESSED
Fig. No. 4643TR
10 Round Thread Upset

6,000 Lbs. TEST
3,000 Lbs. W. P.

SIZE	FIGURE NUMBER	TEST PRESSURE	W.O.G.	A	B	C	D
1¼"	4643TR	6,000	3,000	1⅜	8	12⅞	1 15/16

E	F	G	H	J	K	M	NO. TURNS TO OPEN	WEIGHT
9½	1¼	—	3.105	2.690	1.553	3⅛	10	29 Lbs.



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- B Length — End to End
- C Center to Top of Stem — Open
- D Center to Bottom of Valve
- E Diameter of Handwheel — Overall Swing
- F Radius of Body Recess
- G Location of Top Body Recess
- H Location of Top Body Recess
- J Location of Lower Body Recess
- K Location of Lower Body Recess
- M Tubing Centers

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Scouting Services May Grow

. . . still further as latest company casts an eye toward the Gulf Coast. Oklahoma service will start in August.

COMMERCIAL SCOUTING services soon may be available to operators in the Gulf Coast areas of Louisiana, Texas, and Mississippi.

Data, Inc., Tulsa, suggested last week that extension of its services into the coastal areas would be a "logical move." The company is setting up service now in Kansas, Oklahoma, Arkansas, and the Texas Panhandle.

Its new Arkansas service automatically will fringe scouting areas of Louisiana, East Texas, and Mississippi now handled by regular checks.

Robert J. Riggs, Jr., president of Data, Inc., also announced:

. . . **Appointment** of George M. Dooley, Oklahoma City, as Oklahoma manager for Data, Inc., in charge of the contract scouting in Oklahoma.

. . . **Inauguration** of Oklahoma contract scouting service August 1, with the service to begin operation in Kansas, Arkansas, and the Texas Panhandle by November.

A committee of five company representatives will serve as an advisory board for Data, Inc.'s operations in the four-state area. Members are:

Barron Housel, Bartlesville, Cities Service Oil Co., chairman; Ronald F. Crawford, Lone Star Gas Co.; D. P. Johnson, Pasotex Petroleum Co.; H. D. Fox, Sohio Petroleum Co.; and Grayson Ray, Mobil Oil Co., all of Oklahoma City.

Dooley, formerly with Pan American Petroleum Corp., has been manager of the Oklahoma scout check the past year.

Robert Sink, Wichita, has been mentioned as Kansas manager.

Louisiana Can Unitize Entire Reservoir

LOUISIANA'S new unitization law gives the conservation commissioner authority to force-pool an entire oil or gas reservoir rather than a single unit, as in the past.

Chief Engineer Tom Winfiele of the conservation department explained last week the ramifications of the act approved by the legislature and signed into law by Gov. Jimmie Davis.

Under the unitization law in force since 1940, the commissioner could force-pool only a single-well unit in a single sand, Winfiele said. The new law erases unit lines and permits unitization of the full reservoir.

The bill also treats pools of primary and secondary recovery differently. In the case of primary recovery, only one sand may be unitized; in secondary recovery, either one or two sands may be unitized, the second to be used when needed for makeup gas.

Before the commissioner can order any unitization, however, he must hold a hearing to determine that 75% of the owners in interest have agreed to the program, that additional recovery can be accomplished, and that the program will establish equity among the parties affected.

Winfiele also explained the terms of a second bill signed by Davis amending an existing law on the location of a drilling unit by the commissioner.

The amended law provides that the well for a drilling unit in an oil or gas pool need not be placed approximately in the center of the unit but at any point where it will produce a maximum amount of oil or gas.

Record Pay Found at Canada's Dick Lake

STANDARD Oil Co. of California is claiming two records for its 12-2 South Westerose well in Central Alberta in the northern section of prolific Dick Lake gas field.

The well recorded 676 ft. of effective gas pay in the Devonian D-3 reef formation, a record for the western Canadian plains region. It also flowed 5,000 M.c.f. daily from the Wabamun pay, the first such gas production in the area. There was 26 ft. of net gas pay in that zone.

The record amount of D-3 formation topped the previous high of 650 ft., set by Imperial Oil last year at its 9-23-L Golden Spike D-3 oil strike. Prior to this, the record was held at Berland River where 551 ft. of gas pay was found.

California Standard officials report the D-3 zone was topped at 7,018 ft., cored to 50 ft. above the field's gas-water contact, and finally completed at 7,644 ft. in the D-3 zone.

Oil and gas showings also were encountered in the Nisku Devonian at 6,688-6,708 ft.

The Westerose well was drilled on a lease wholly owned by California Standard about 6 miles northeast of new processing facilities now being built 50 miles southwest of Edmonton. California Standard also holds an interest in considerable acreage in the area with British American, Phillips, and Canadian Husky.

Dick Lake field is scheduled to become one of the largest single suppliers of gas for export. The processing plant being built in the area will have the largest capacity of any single facility in western Canada.

British American is building the plant on behalf of all field operators. Initial costs will exceed $10 million and may reach $17 million with later additions.

The plant will have capacity to process 326,000 M.c.f. daily of raw gas. Of this 200,000 M.c.f. daily is scheduled to come from South Westerose field and 126,000 M.c.f. from Homeglen-Rimbey field.

The reserve of South Westerose (Dick Lake) field currently are estimated at 1.455 trillion cubic feet of recoverable pipeline gas.

On the basis of completion and deliverability tests, the seven producers completed to date are estimated to have sustained deliverability sufficient to meet requirements for the first few years. Current deliverability is 226,000 M.c.f. daily and likely could be increased to 300,000 M.c.f. by drilling four or five more locations within the next 5 years.

INDUSTRY

Gulf-Mobile-Humble have completed a wildcat well in Block 169, Ship Shoal area, 28 miles off the Louisiana coast, and 12 miles east of nearest production. The well flowed at a rate of 379 bbl. daily of 36.1°-gravity oil through an 11/64-in. choke. Producing zone is 9,300 ft. and the well was bottomed at 13,217 ft. Each of the three partners has a one third interest.

Oil companies paid $2,666,800 for leasing 38,000 acres of University of Texas lands last week. Texas Gulf Producing Co., Houston, paid highest prices of $210,000 and $195,000 for two 160-acre tracts in Crane County.

Double-A Drilling Co., Ltd., Calgary, has been purchased by Llano Drilling Co., Midland, Tex. Double-A operates three rigs. Llano said no

Indiana Standard Steps Out of Operations

- **It becomes strictly a holding company with last reorganization move.**

John E. Swearingen | W. Cushing Smith | L. W. Moore

CLIMAX of a 6-year reorganization program will come next January when Standard Oil Co. (Ind.) places its far-flung refining, marketing, and transportation activities under one subsidiary.

The operating firm will be American Oil Co. It will be a single company with unified management, common trademarks, and brands.

It will continue marketing under the Amoco banner. Assets of Utah Oil Refining Co. and Indiana Standard will be transferred to the subsidiary, according to Indiana Standard president, John E. Swearingen.

L. W. Moore, now president of American Oil, will continue as chief executive officer with F. Cushing Smith as executive vice president. Smith presently is an Indiana Standard director and general manager of supply and transportation.

The move will free Indiana Standard of all operating activities and leave it strictly a parent company. This will permit its executives and staffs to concentrate on over-all policy, guidance, coordination of operations, evaluation of performances, and planning for future growth.

The reorganization generally will not affect operations of other affiliated companies concerned with exploration, production, or purchase of oil and gas in this country and abroad; domestic crude oil pipeline transportation; petrochemicals and foreign refining and marketing.

These activities are carried on by Pan American Petroleum Corp., Pan American International Oil Corp., Indiana Oil Purchasing Co., Service Pipe Line Co., Amoco Chemicals Corp., Tuloma Gas Products Co., and Amoco Trading Corp.

The Indiana Standard reorganization program began in 1954 when American Oil became a wholly owned subsidiary. Full ownership of Utah Oil was acquired in 1956.

Nine wholly owned subsidiaries were reorganized into four operating companies in 1957, and the marketing structure of both the parent company and American Oil were streamlined the same year. In January of this year, the research work of all subsidiaries was consolidated into one organization.

Brand changes . . . Amoco President Moore quickly announced the lineup of brands to be used when the reorganized marketing setup takes place.

Major gasoline brand names are:

. . . American Regular to be used in all marketing areas.

. . . American Super Premium to be used in areas where Indiana Standard and Utah Oil presently market.

. . . Amoco Premium to be used in areas where American Oil presently markets its unique unleaded premium gasoline.

In addition, Amoco plans to use the brand names American Heater Oil and American Furnace Oil company wide.

BRIEFS . . .

changes in policy nor personnel are planned.

Renwar Oil Corp., Dallas, says it has reached "agreement in principle" on sale of the company to Tennessee Gas Transmission Co. (OGJ, July 4, p. 73). D. W. Forbes, secretary-treasurer, said it will be mid-September before the sale is consummated. Renwar has 2,700 bbl. daily crude production and owns two gasoline plants.

A high bid of $37,433 was made by Jake L. Hamon, independent Dallas oil operator, for 1,035 acres in Chase field near Corpus Christi. The property is owned by the Defense Department.

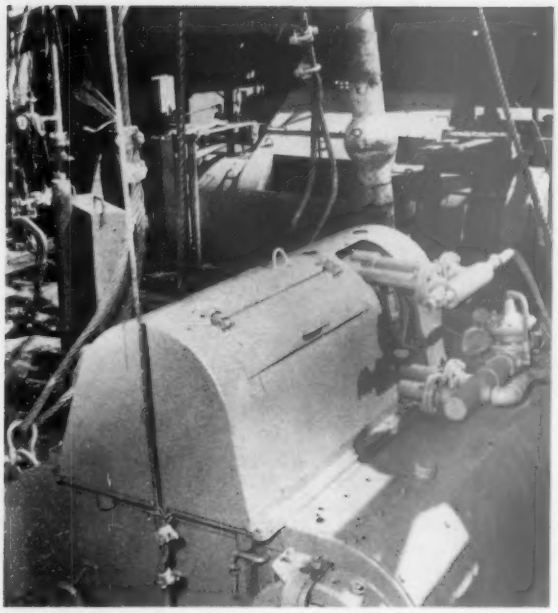
The sister ship of the world's largest tanker has been launched at Kure, Japan, shipyards. The new vessel is the Universe Daphne. She and the sister ship, Universe Apollo, have a deadweight of 106,400 tons. The Daphne is scheduled to carry crude from the Persian Gulf to Japan under charter to Gulf and Idemitsu Kosan Oil Co.

Reading & Bates Offshore Drilling Co. has purchased two drilling tenders, one from Gulf Oil Corp. and the other from Llano Drilling Co. One has been named the "George L. Temple" for R&B's New Orleans manager and the other the "J. W. Nickle" for the company's offshore drilling superintendent. The company has equipment running in both the Gulf of Mexico and the Persian Gulf.

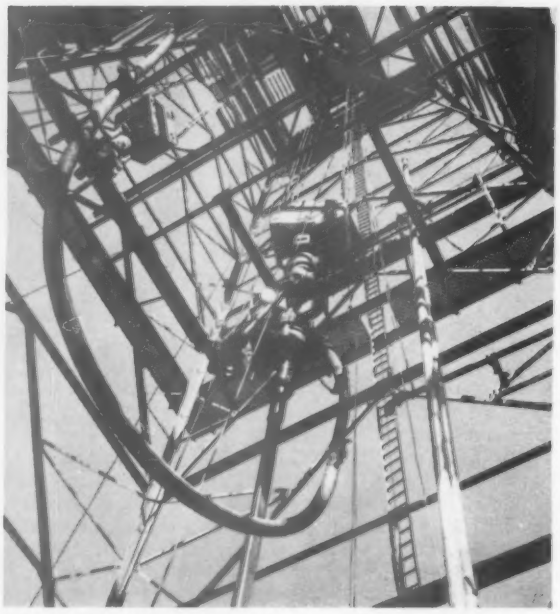
Southern Counties Gas Co. plans to file for a rehearing before the California Supreme Court of its case against Richfield Oil Corp. The court recently ruled Richfield's gas operations are not a utility-type operation and do not come under jurisdiction of the state's Public Utilities Commission. (OGJ, July 11, p. 65). The gas company sought to place Richfield's gas operations under PUC control after the oil company built a pipeline to serve an electric utility with gas.

Spencer Chemical Co. has added extensive coal-mining operations with the acquisition of Pittsburg and Midway Coal Mining Co. During its fiscal year ended March 31, Pittsburg and Midway had sales in excess of $16,000,000 and net income of approximately $1,750,000.

The inauguration of Esso Petroleum's new deepwater tanker terminal at Milford Haven, Wales, was marred by explosions and fire aboard the Esso Portsmouth, a 36,040-ton tanker which was unloading about 250,000 barrels of Kuwait crude. At least one seaman was killed.



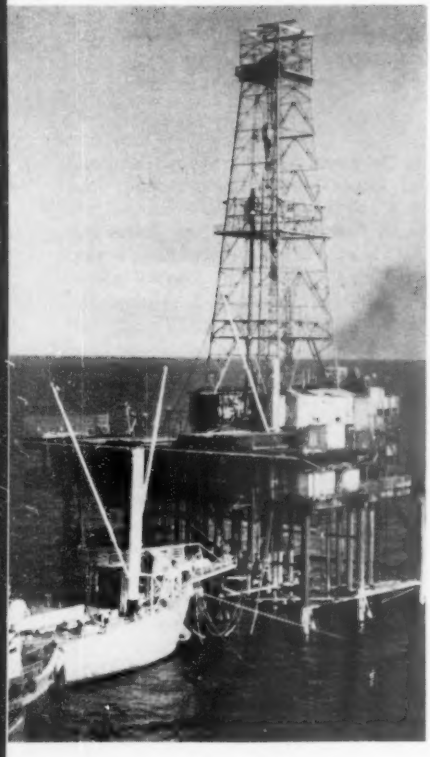
TWO DRAW WORKS shown on the same derrick floor above provide plenty of hoisting power for . . .



DUAL TRAVELING blocks in an unusual offshore drilling operation resulting when . . .

Loffland Uses Two Rigs on One Derrick

• While a heavy-duty rig drills, a lighter unit does completion work or handles workovers on California Co.'s 18-well platform in Bay Marchand field.



UNUSUAL versatility in offshore drilling is being achieved by Loffland Brothers Co. The company is using two rigs on a single derrick.

Under this 2-in-1 system, a drilling crew can complete or work over one well while drilling another on the same derrick floor.

The efficiency and economy of the idea for both the drilling contractor and the operator is being proved by Loffland on a job for the California Co. The work is being performed on California's "R" Structure about 30 miles south of Leeville, La., in Bay Marchand field.

Loffland supervisors and crews are using the dual equipment to drill 18 directional wells from the same structure.

The setup . . . The idea of two rigs on a single derrick is not exactly new.

An offshore platform built for California Standard and Humble to do work off the West Coast was equipped with a derrick capable of handling two drilling rigs (OGJ, Dec. 2, 1957, p. 72).

Loffland's use of the idea, however, is unusual. Loffland is working one heavy-duty drilling rig and a lighter completion or work-over unit from the same derrick. This gives flexibility to both crew and equipment that results in considerable savings.

The drilling unit—Rig 130—is equipped with a Mid-Continent U-914 draw works powered by four Waukesha 6-cylinder diesel engines of 460 hp. each at 1,200 r.p.m. There are two 700-hp. slush pumps and a 500 hp. auxiliary pump powered by a Cummins diesel engine. The rig has a 500-ton Regan traveling block, a Gray swivel and a 27½-in. rotary table.

The completion and workover rig—Rig 155—features a Mid-Continent U-15 draw works powered by a Cummins VT-12 Turbo-diesel 600-hp. engine.

The Lee C. Moore derrick is 156-ft. high from the floor to the gin pole and 142 ft. from floor to top of the crown. It stands on a substructure 24 ft. high which is supported on giant caissons or pilings 300 ft. long. These rise out of the water about 50 ft., depending on Gulf tides.

Mud tanks for the drilling rig are adjacent to the substructure on the lower level of the platform along with the production equipment. A converted World War II LST is anchored

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next to the platform for pipe and cement storage, crew quarters, emergency evacuation, and other uses. Mud tanks for the completion rig are located on the LST.

Advantages . . . The double duty rig holds its greatest advantage in saving both time of the rig and the crew.

The usual practice offshore is to use conventional drilling rigs for completion and remedial work. This ties up a rig for days or months at a time.

One rig near the Loffland-California location was tied up for 2 months early this year doing nothing but workovers. Using this heavy, expensive equipment for minor jobs is extremely costly.

The system of rigging up two rigs in the same derrick permits the heavy-duty rig to concentrate on drilling new hole. The lightweight rig handles the completion work or the workovers.

Another advantage arises from the fact that one contractor does both the drilling, the completion, and remedial work.

Thus there are potential advantages and savings for both the drilling contractor and producing company. The contractor stands to get more work through his versatility and profit from crew efficiency. The producer gains by more efficient use of equipment.

Drilling plan . . . Loffland will drill six directional wells from each of three derrick positions on the structure.

The rig is skidded from location to location in a matter of hours on specially notched skidding beams powered by three powerful hydraulic jacks.

Location of the 18 holes at their completed depth is carefully calculated in advance. Each well is assigned a hypothetical cylinder in which the bit must consistently stay. The angle of deviation runs as high as 23°. Completion depths in Bay Marchand field average about 11,000 ft.

The most consistent challenge to the offshore work—in addition to weather hazards and supply problems—is this constant requirement for directional drilling.

Kenai Test Hits 8,000 Ft.

HALBOUTY Alaska Oil Co. and King Oil Co. drilled below 8,000 ft. last week on their Kenai Peninsula wildcat in Alaska. The well, spudded June 16, is expected to hit a projected depth of 13,500 ft. by mid-September.

The wildcat is 9½ miles southwest of production in the Soldotna unit (OGJ, June 20, p. 94). The operators set 3,000 ft. of surface pipe and have encountered no drilling difficulties so far.

watching WASHINGTON

Clyde La Motte

• Is Washington important to your operation? . . .

A WASHINGTON oil editor recently made a swing into Oklahoma and, briefly, into Texas. From time to time he ran into this comment from some resident of the oil patch:

"Washington must be an interesting place. Personally, I'm too busy trying to make a buck to pay much attention to the goings-on there."

This startled the oil writer somewhat, for it was his impression that the making of a buck—or the keeping of a fraction thereof—is often highly dependent on "the goings on there" in Washington.

Take the matter of taxes. More and more decisions by oil companies are being delayed until after the firm's tax expert has figured out what the tax impact would be on a proposed venture. Thus, any changes in tax structure or in tax regulations have a direct bearing.

Right now the Internal Revenue Service is mulling over a proposed regulation on intangible drilling costs that could have a big impact on many oil and gas producing operations (OGJ, July 4, p. 70).

And the Treasury Department is making a new study of tax writeoffs for depreciation. It may decide to shorten the period for many types of equipment and facilities. If so, you'd have a larger deduction when you compute your taxes. This could provide you with a dollar you wouldn't otherwise have had for use in expansion or other purposes.

On a broader scale, suppose Congress should whack percentage depletion. You'd feel the impact regardless of the segment of the industry in which you operate. And the impact would be on your pocketbook.

• Many agencies have a hand on your pocketbook . . .

TAXES ARE only one of the many ways Washington actions affect your ability to make or keep a dollar.

You may have contracted with an interstate pipeline to purchase your gas at, say, 20 cents per M.c.f. But the Federal Power Commission in Washington may decide that the price should be 15 cents. You automatically lose 5 cents per M.c.f.

This price cutting affects more than just the producer involved, too. It affects you if you are a driller, an equipment salesman, a geologist or what not for naturally there will be more activity in the oil patch if natural gas is selling for 20 cents than if it is selling for 15 cents.

Don't overlook, either, the power the Interior Department has to help or hurt you. With its hands on the valve controlling oil imports, Interior can easily affect the number of days you can produce, or the market you will have for your crude or products, or the price you will get.

• Like it or not, Uncle Sam is your partner . . .

IF YOU get too intent on making an honest dollar, without keeping an eye on the goings on in Washington, you may have Mr. Bob Bicks of Washington calling upon you.

Bicks is the chief anti-truster in the Justice Department, and either he or the Federal Trade Commission may decide that some competitive practice long used in the industry is illegal, thereby forcing a change in your dollar-making methods.

Even more likely, should you decide to sell your company—perhaps to keep it from going on the auction block to pay inheritance taxes when you die—you may find that you can't make the sale because of Bicks' crackdown on mergers. More than a few dollars may be at stake.

The above are only a few examples of how the goings-on in Washington are tied to your purse strings. In other words, Uncle Sam is your partner. And he's far from a silent one.

"Edward Mudwonder Valves are easier to operate, easier to service, and they last longer,"

says Dick Dyer,
Toolpusher,
Rig #20,
Mabee Drilling Co.

With drilling becoming more costly and more competitive than ever before, equipment selection and maintenance costs have taken on increasing importance for Mabee Drilling Company of Midland, Texas. Here's how Dick Dyer puts it.

"When I started working for Mabee Drilling Company—then known as Guy Mabee Drilling Company—seventeen years ago, we used mud valves until they wore out, then threw them away. In those days we had no choice. But, those days are gone forever. That's a luxury we can't afford any more.

"Now, when other mud valves wear out, we replace them with Mudwonders. We have learned from experience that they are easier to operate, easier to service, and they last longer."

Edward Mudwonder valves are built in 2", 3", and 4" sizes, with screwed or flanged ends, for 2000 psi WP (4000 psi test) and 3000 psi WP (6000 psi test) service and in 2" size for 5000 psi WP (10,000 psi test) service. See your favorite oil field supply store, or write Edward Valves, Inc., 1212 W. 145th Street, East Chicago, Indiana. Subsidiary of Rockwell Manufacturing Company.

◀ Mudwonder cut-away view shows the one-piece seat insert with Buna-N molded integrally over steel wear rings; chromed gate with "T" slot connection; separated stainless stem and double thread construction.

▲ Dick Dyer, Toolpusher on Mabee Drilling Company Rig #20, on the job just south of Kermit, Texas.

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India Pushes Coexistence in Its Oil Program

• It seeks and gets more Soviet technical help, but promises there will be no Cuban-style reprisals against free-world refiners who refused to process cheap Russian crude. It wants western companies to do exploration work.

INDIA REASSURED oil companies last week that they face no Cuban-style reprisal for refusing to process Russian crude.

Oil Minister Keshiva Deva Malaviya made the promise after three companies turned down a government request to refine Soviet oil. The firms are Burmah-Shell (Burmah Oil Co. and Royal Dutch-Shell) which has a 50,000 bbl. refinery at Bombay; Stanvac with a 38,000 bbl. plant at Bombay; and Caltex with a 15,000 bbl. plant at Visakhapatnam.

The three refine and market more than 75% of the Indian demand of about 120,000 bbl. daily.

The minister made the statement after he returned from a 3-week trip to Russia where he secured a promise of more Soviet aid for a government-run oil development program.

The reassurance for western companies and the courting of Russian aid is in line with India's policy of trying to make bedfellows out of communist and free-world oil men.

Malaviya disclosed that 100 more Russian technicians are on their way to India to supplement Russian and Romanian personnel already in the country. Most of the newcomers will be assigned to the Cambay discovery area north of Bombay.

At the same time India is actively seeking western oil companies as bidders for exploration rights under new concession rules.

The purpose of the Indian program is to develop a major producing industry within a short time. Malaviya, while in Moscow, repeated India's hopes to be self sufficient in crude by 1966. Demand in 6 years is expected to rise to 280,000 bbl. daily.

Domestic output of 8,500 bbl. daily will rise to 65,000 bbl. daily when a pipeline from the Nahorkatiya area of Assam is completed but the remaining supply of more than 200,000 bbl. daily still must be found and developed.

Refining Intentions . . . Malaviya said India intends to live up to its 20-year agreements with Caltex, Stanvac and Shell whether or not the companies run Russian crude. He served notice, however, that the contracts would face major revisions when they come up for renewal in 1968.

Parts of the agreements specify that companies may import and refine oil from their own sources. Russia reportedly offered India crude at 10% below market prices, a figure that would make the oil attractive to India because of possible savings in foreign exchange.

The offer of Russian crude still stands, and India can accept when it wants it.

The oil minister said there were no discussions in Moscow about the establishment of an Indian-government refinery to process Russian oil. Neither was there any discussion about joint Russian-Indian refining operations for any oil found by India's Oil and Natural Gas Commission.

Cambay activity . . . Most of the 100 Russian technicians will go to the Cambay region, where possibilities of a commercial oil field are considered fair.

There already are 45 Russians and 35 Romanians working in the Oil and Natural Gas Commission in addition to 300 Indians.

Five wells completed at Lunej, 8 miles west of Cambay, indicate the presence of gas and oil. The sixth well is drilling and site preparation is in progress at two or more locations as part of a program to drill 14 more wells by the end of the year. The structure covers about 10 square miles.

The wells vary in depth from 1,800 to 2,000 meters, or about 5,900 to 6,560 ft. Two of the four rigs in the field are operated by Romanian crews and two by Russians.

Geologically the Gulf of Cambay is a relic of a water area that once separated Saurashtra Peninsula from the Indian mainland. Most of the sediment deposits are covered by river alluvium, but there are outcrops along the rim of the basin.

The discovery was completed in 91 days at a total depth of about 7,200 ft. after encountering oil and gas sands between 4,300-5,620 ft. The high pressure gas caused some trouble at first and tests indicated the best pay was at 5,250 ft.

The second well, about one mile east, yielded gas, oil and water under high pressure. The third well to the south tested more than 4 million cubic feet of gas daily. The fourth and fifth wells also yielded gas.

Drilling time has been cut to 20 days per well but operations are hampered by down-hole temperatures as high at 230° F. and pressures as big as 5,140 psi.

European Turkey May Have First Strike

THE FIRST discovery ever made in European Turkey has been brought in by a joint German and Royal Dutch-Shell exploration program.

Kuleli 1, drilled 22 miles east of Edirne, in the northern part of Thrace, encountered gas and oil in Tertiary at 2,700 meters, or about 8,850 ft. Commercial prospects of the find still are undetermined. The well had an intermittent flow of gas, oil and water on production tests. The find is on concessions that were pooled by Deilmann Petrol Ltd. and NV Turkse Shell after negative results in separate programs.

Kuleli is the second hopeful sign since exploration began on concessions awarded 4 years ago under a new oil law. American Overseas has a small, three-well field at Kahta, found in 1958. A Turkish Government company produces about 6,700 bbl. daily from three small fields. These four fields are in southeastern Turkey.

15 ways to say CAPABILITY *in formation fracturing*

ca/pa·bil/i·ty (kā/pə·bĭl/ĭ·tĭ) *n.* ; *pl.* -TIES (-tĭz). 1. Quality of being capable; capacity; esp., intellectual capacity. 2. a Capacity of being used or developed. b A feature, condition, faculty, or the like, capable of development; — usually in *pl.*

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WATERFRAC

SAND-WATER

SANDOIL

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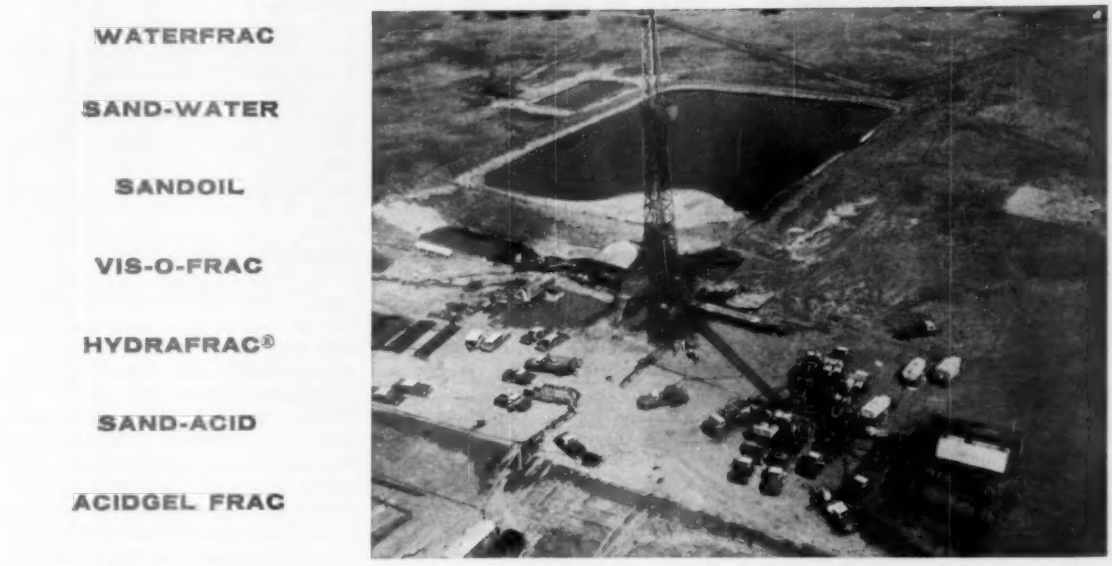

THE WORLD'S DEPTH RECORD for a successful fracturing operation was recently performed in Oklahoma using Halliburton's CHEMFRAC process . . . a method of injecting sand with a controlled emulsified acid solution. Deepest injection was at 15,758′ in the Bromide formation.

When you program your next fracturing job, design it around one of these *proven* Halliburton processes. Each process has been carefully developed for best performance in a given group of formation conditions. Together, they provide a multitude of solutions to fracturing problems the world over.

Take advantage of this complete fracturing line-up . . . plus the coordinated effort of your nearby Halliburton Fracturing Team. You'll see an unmatched combination of Halliburton men, materials and equipment working with a single aim . . . to help you get the *most* performance from your fracturing dollar. Call your local Halliburton Representative.

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Cuba Gets Oil; Tanker Owners Get Warning

• Soviet crude for seized refineries arrives. The major companies who own the refineries indicate it would be bad business for tanker owners to make charters which would help Castro get a steady flow of oil to his island.

FRESH SUPPLIES of Russian crude flowed into tank farms of seized Cuban refineries last week as independent tanker owners received warnings of a loss of business, if they charter to the Soviets.

The incoming shipments made it clear that Premier Fidel Castro's government faced no immediate oil shortage.

The warning to tanker owners was issued by Jersey Standard. The company's 36,000-bbl. Belot refinery was one of three taken over by Castro because the companies refused to process Russian oil.

Texaco with a 20,000-bbl. plant at Santiago de Cuba and Shell with a 27,000-bbl. plant at Havana, both of which were seized, did not make formal statements. But they indicated they would be "very disappointed" if their business friends did business with Cuba.

Shell de Cuba is fighting the seizure of its refinery in Cuban courts. It has started proceedings claiming the two resolutions under which the government intervened are unconstitutional. These were orders signed by Premier Fidel Castro and Alfonzo Gutierrez, director of the Cuban Petroleum Institute.

The Dutch government is asking Cuba to permit Shell to resume its activities and is seeking compensation for losses already taken by the company. Earlier protests made by the British and U. S. governments have been rejected.

Mexico, a possible supplier for Cuba, took an on-the-fence stand by offering sympathy for Cuba and suggesting regular inter-American channels as the way to settle the Castro-U. S. dispute. The U. S. pressed Mexico for its official stand after left-wing Mexican congressmen sided strongly with Castro following the seizure of the refineries.

Tanker boycott . . . Jersey, one of the world's biggest users of tankers, told tanker owners and brokers that in regard to future commitments it and its affiliates "will take into consideration whether tanker owners are now chartering or selling tankers to the Russians for any trade and will also take into consideration in the future which ship brokers are dealing in tankers for the transport of Russian Black Sea oil."

Jersey termed the statement as an expression of its feelings rather than as official company policy, but there was little doubt that the purpose was to put at least a partial crimp in shipments to Cuba.

Another major charterer took a stand beside Jersey. Golden Eagle Refining Co. Inc. (California) and Golden Eagle Refining Co. of Canada advised brokers and owners there would be no future tanker charter or bunker sales from companies or individuals who assist the Russia-Cuba oil alliance in any way.

W. L. Theisen, marine manager for both American and Canadian Golden Eagle, said: "A prompt and firm policy even from us smaller companies is required to stop the degradation of Cuba's petroleum industry which is being perpetuated by the cooperation of ship owners and brokers who charter for deliveries of Russian crude to the refineries recently confiscated."

The Golden Eagle companies, recently acquired as 100% subsidiaries of Ultramar Ltd., charter both clean and dirty ships. Ultramar is the fourth biggest British oil company.

Shippers believe the boycott will discourage many owners and brokers from doing business with one of the Russian charter agencies. But others, faced with a choice of leasing vessels to Russia or seeing them tied up, will make deals with the Soviets. An estimated 26 tankers of the World War II T-2 type can keep Cuba supplied with oil from Black Sea ports. Even fewer of the newer, bigger and faster vessels would be required.

The Cuban government has put out feelers for chartering or buying tankers, but it offered payment in pesos and no owner is expected to be interested on this basis.

Polypropylene Patent Fight Looms in Japan

A PATENT STRUGGLE may be shaping up in Japan over American and Italian processes to manufacture polypropylene.

The action which may have touched off the fight was the signing of a preliminary contract by Shin Nippon Chisso Hiryo K.K. (New Japan Nitrogen Fertilizer Co.) for the manufacture of polypropylene by the AviSun process. AviSun is jointly owned by American Viscose and Sun Oil Co.

The Shin Nippon move came at a time when several other Japanese firms were vying for rights to use the Montecatini process. It raised the question of whether the AviSun process can be used under Japanese licensing laws. Shin Nippon claims the AviSun process uses an entirely different catalyst and does not infringe on Montecatini patents.

Under the agreement with AviSun, Shin Nippon would build a 13,000-ton per year plant, which would open by April 1962. It would pay AviSun $1.7 million when the Japanese Government approves the project, and another $1.7 million when the plant goes on stream. It also would pay a royalty of 5% until total royalty payments reach $2.2 million.

AviSun, on its part, would supply the Japanese firm with the latest developments in polypropylene technology for 5 years. It would guarantee the product quality, and agree to exports of the product to markets other than the U. S. and western Europe.

Propylene feed is to be supplied by Maruzen Oil Co., which is planning a new refining and petrochemical complex at Goi, Chiba Prefecture.

The asking price by Montecatini reportedly is considerably higher, with initial payments of $3 million, plus running royalties of 5% of total sales for 15 years. This would bring total payments to more than $10 million.

Mitsui Chemical and Mitsubishi Petrochemical had a preliminary agreement with Montecatini which expired in April. Reports from Tokyo are the government refused to approve the deal in the belief the price was too high. Since then several companies have tried to win the rights.

Persian Gulf Well

. . . is staked off Bahrain by Caltex affiliate.

ANOTHER PERSIAN Gulf drilling program will get under way this year when Bahrain Petroleum Co. starts its first offshore well off the north coast of the island.

The Caltex affiliate is setting up a permanent platform at Fasht al-Jarim, a shoal about 15 miles north of Manama. The structure will stand in 5 ft. of water at low tide, and carry the company's National 100 rig.

V. A. Isaacs, manager of production and development, classifies the well as "strictly a wildcat." He says the test will study the various horizons now productive on the mainland.

The Fasht shoal area is composed of coral covered by sand. It lies under water except during extreme low tides. This creates a delivery problem for equipment and supplies, since all ship movements are controlled by the tides in the approach channel.

Production on the mainland is a settled 45,000 bbl. daily from the island's only field. Output is from two horizons, Bahrain Zone, at 2,200 ft., which spurred drilling on the Western side of the Persian Gulf when it was found 28 years ago; and Fourth Pay, at 4,500 ft.

Bapco is the sixth company to undertake drilling operations in the Persian Gulf. Aramco was the first, and it has two commercial offshore fields, Safaniya and Manifa. Safaniya is on commercial production. Definitely commercial finds also have been made by the Japanese-owned Arabian Oil Co., off the Neutral Zone, and by a joint British Petroleum-CFP company off Abu Dhabi.

In the northern part of the gulf, a joint Italian-Iranian operation is below 11,000 ft. in a well that reportedly has tested 3,500 bbl. daily and 5,000 bbl. daily from higher zones. Pan American International, in another joint venture with Iran, is testing shows in a well bottomed at 13,152 ft.

The latest find has been made by Shell Co. of Qatar, which is testing oil found in Idd El Shargi 2, located 52 miles east of Qatar (OGJ, July 4, p. 77).

Pakistan Wildcat Gets Gas

EXPLORATION play has taken a turn for the better in both East and West Pakistan.

In the eastern part of the country, Pakistan Shell Oil Co. has encountered high pressure gas in Rasidpur 1, in Sylhet District. The well is now below 11,800 ft.

In the West wing of the country, Attock Oil Co. is testing 500 bbl. daily in a long step out at Dhulian.

U.K. Gasoline Cut

. . . one penny a gallon as competition stiffens.

COMPETITIVE PRESSURE on gasoline in the United Kingdom has forced widespread cuts of about one cent per gallon.

Major marketers have made a reduction on many grades of 1 pence per Imperial gallon, which is roughly equivalent to one cent per U. S. gallon. The cut applies to gasoline sold at retail stations.

The general decline in price reflects a growing uneasiness in Europe's best gasoline market, where sales last year rose to 168,000 bbl. daily. It follows an outbreak of price-cutting by name brand retailers in isolated cases, and an organized campaign which is attempting to wean station owners away from major companies.

Wholesale prices are holding steady. Suppliers absorb the reduction by making rebates of one pence per gallon to retailers. Commercial buyers pay the same price based on the wholesale cost. But these customers have been benefiting from discounts of as much as 4 pence per gallon on large orders.

The downward movement is expected to stiffen the position of established marketers who face growing competition from companies with new supplies of products. Commercial buyers have been shopping abroad for bargains in gasoline, and the country's retail dealers association is urging its members to go independent, or make better deals with their suppliers when present contracts expire (OGJ, June 20, p. 96).

Many of the contracts, which 80% of the stations have, expire this year or next.

FOREIGN BRIEFS . . .

Permits covering 5-million acres in Amedeus Basin of Australia's Northern Territory have been awarded to Magellan Petroleum Corp. The grant brings the company's total concessions in the country to more than 20 million acres. Magellan has applications pending on an additional 1.4-million acres in the Amedeus basin area.

Another mobile platform has been ordered by Italy's ENI from R. G. LeTourneau. This is the third offshore platform the government-owned company has ordered from the American company in 2 years. The first is operating in the Adriatic Sea and the second is being assembled at Massa, Italy.

A new $28 million synthetic-rubber plant has opened at Royal Dutch-Shell's big refinery at Pernis, Netherlands. Facilities include styrene, butadiene, and styrene-butadiene units. The 60,000-ton per year output is equivalent to the natural rubber produced on a 150,000-acre plantation.

Esso Petroleum will expand petrochemical facilities at its Fawley, England, refinery with the addition of steam-cracking ethylene recovery and butadiene extraction units. Foster-Wheeler has a construction contract for the $15.4-million program scheduled for completion by end of 1961.

Phillips Petroleum and Pantepec Oil are resuming drilling operations on a jointly held 18,000-acre El Roble concession in Anzoategui, eastern Venezuela. Phillips will be the operator in the area.

Shell Tankers is beaching the Auris, a 12,000 ton tanker used for 9 years to test gas-turbine propulsion. The company has decided against gas turbine power for any of its other tankers.

Rhine Valley Gets More Crude

. . . from the newly opened line linking three West German refineries with a North Sea terminal at Rotterdam.

EUROPE'S FIRST international crude pipeline has gone into operation with the opening of the 185-mile, 24-in. system from Rotterdam in the Netherlands to West German refineries along the Rhine River.

The $28-million system has an initial capacity of 8.5 million tons per year, or about 170,000 bbl. daily. Additional pumping stations later may increase throughput to as high as 400,000 bbl. daily. There are pumping stations now at Pernis and Venlo.

Crude from a tanker terminal at Pernis, in the Rotterdam harbor area, is moved 95 miles to Venlo, where the line splits into two branches. The southern, 63.5-mile branch supplies Shell's new 85,000 bbl. refinery at Godorf, and the 64,000 bbl. Union Rheinische refinery at Wesseling, which processes crude for Caltex.

The 28-mile northern branch ties into an established 25-mile 16-in. line from Wesel to Gelsenkirchen. The 16-in. line originally was built to deliver crude brought up the Rhine River by barge to Gelsenberg Benzin's 95,000-bbl. plant.

H. J. Slingenberg, joint managing director of Rotterdam-Rhine Pipeline Co. called the firm's new system a visible sign of the progress of European integration. He said pipelines coming into Europe are an attractive target for new forms of taxation, and warned against the temptation of imposing artificial burdens. "Our aim," he said, "is, and will remain, to provide energy to Europe's growing industries in the cheapest and most efficient way possible."

Parent companies of the pipeline company are a subsidiary of Royal Dutch-Shell with 40% interest, Gelsenberg & Mobil Oil Handels—und Transport Geselschaft, 40%, California Texas Corp., 20%.

Indian Carbon-Black Unit Set

ENGINEERING and design work is under way on a carbon-black plant to be constructed near Durgapur, India, by Phillips Carbon Black, Ltd.

A feed stock of coal-tar distillates will be used in the plant, which will have an initial design capacity of 22 million pounds a year.

The plant is expected to be in operation within the next 18 months.

Phillips Petroleum Co. owns 30% of the carbon black firm and an equal interest is held by Duncan Brothers & Co., Ltd., of Calcutta. Remaining shares are publicly owned.

Phillips is also constructing carbon black plants in France, South Africa, and Italy in partnership with other companies.

Austrian Payments

. . . for oil companies' war losses are imminent.

AFTER 5 YEARS of simmering, an agreement now appears imminent between oil companies and the Austrian Government over reparations for properties taken over by the Nazis in 1938 and by the Russians in 1945.

Owners of RAG, Mobil and Royal Dutch-Shell, have approved an offer made earlier this year by the Austrian Cabinet. Final approval by the government is the only remaining hurdle to the agreement, and this is expected soon.

The pact will wrap up negotiations that date back to the Vienna Memorandum of 1955, under which Austria regained its freedom from postwar occupation.

The agreement provides for separate exploration and producing operations by RAG and the government company, OMV. But all crude produced by the two groups, with the exception of the government's reparation shipments to Russia, will be sold to a new marketing company.

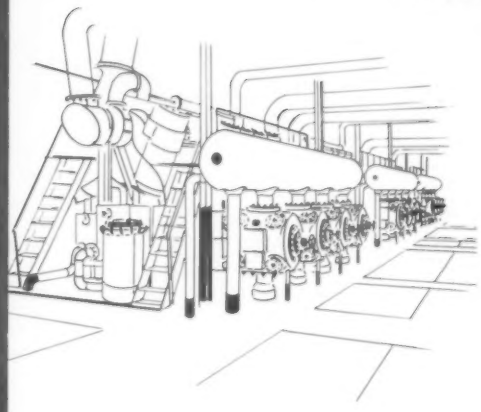
This company will be owned 74% by OMV and 13% each by Mobil and Shell. It will sell the crude to refineries owned by the parent companies, then buy back finished products for redistribution among the partners.

The new company will take more than 20,000 bbl. daily of OMV's production, and 3,300 bbl. daily from RAG. OMV sends another 20,000 bbl. daily to Russia.

Austria also will pay RAG $13.7 million in six annual payments as part of the agreement. Half of this amount will be paid back to OMV as advanced fees for refining crude at the government's new 40,000 bbl. refinery at Schwechat. Part of the rest of the payment will be used by RAG for exploration in Upper Austria.

Mobil operates a 3,400 bbl. plant at Kagran, and Shell a 4,500-bbl. plant at Floridsdorf. Both plants date back to before World War II. Most present Austrian crude output is from properties held by RAG before the war.

This electronic compressor station analog, installed at Ingersoll-Rand's compressor and engine plant in Painted Post, N. Y., is now in use for piping analysis.



Taking the PULSATIONS out of a pipeline station

If you've ever seen compressor manifolds and piping resonate like an organ pipe, you know that gas pulsations can create serious problems which are costly and time-consuming to correct. But this evidence isn't always present to warn of piping troubles—the pulsations may be too small to shake the pipes, but still cause poor compressor performance.

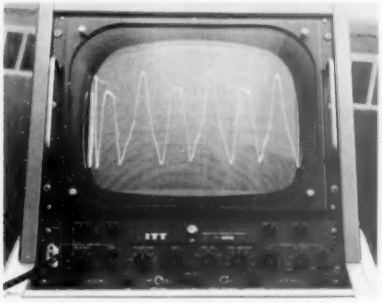
It involves long, complex calculations, by conventional methods, to design optimum manifold and piping arrangements for any compressor installation.

But now Ingersoll-Rand has taken the headaches and guesswork out of piping specifications, with the installation of a new "compressor station analog"—the most modern, most precise unit of its type in the world. By setting up an electronic simulation (or analogy) of any compressor installation, pulsation patterns and their effects can be predicted and measured with higher speed and accuracy than before possible.

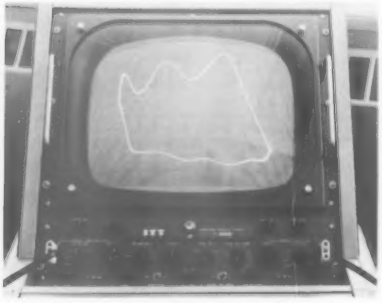
(continued overleaf)

Ingersoll-Rand

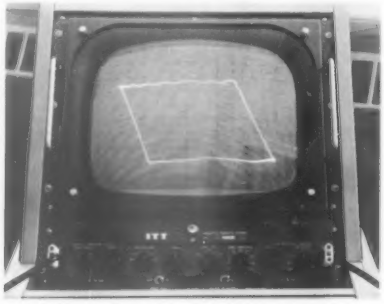
How Ingersoll-Rand's **Compressor Station Analog** can prevent piping problems for you



This screen shows the pulsations which will occur at a selected point in a proposed compressor manifold and piping arrangement, indicating that changes should be made to prevent trouble.



The irregular indicator card pattern on this screen shows that pulsations in the system under analysis will cut down the efficiency of the compressor.



Here, using a corrected piping arrangement, the harmful effects of pulsation have been entirely eliminated, resulting in the correct pattern for top efficiency.

(see overleaf)

Designed and built especially for Ingersoll-Rand by the Southwest Research Institute of San Antonio, Texas, this electronic compressor station analog incorporates all the latest improvements which have been developed from experience with equipment previously supplied.

In operation, an electronic "model" of the compressor and its manifolds and piping is set up on the analog by means of plug-in components. Electric current is analogous to gas flow, and voltage is analogous to pressure. Compressor valves are simulated by diode tubes. Up to six cylinders may be simulated in any possible phase relationship, and any piping configuration may be set up for study.

On a calibrated oscilloscope screen, a visual pattern represents pressure waves taken from any point in the system. Another instrument makes a harmonic analysis of pressure variations and shows the size and frequency of each component. Indicator card diagrams of conditions inside the compressor cylinder may also be shown on a screen, for analysis of pulsation effects on compressor performance. Permanent records may be made by a camera attached to the analog. Various piping arrangements may be quickly tried on the analog to predict any faults, thereby preventing costly mistakes with the actual installation.

This analog has been made available solely for the benefit of Ingersoll-Rand's customers. In addition to *avoiding* problems on new installations, it can *diagnose* troubles in operating installations and permit quick remedy at minimum cost.

To take advantage of these facilities, get in touch with your Ingersoll-Rand engineer. You'll find him always ready to help with your other compression problems, too.

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The World's Most Comprehensive Compressor Experience

Operating conditions can be a practical guide to Miscible-flood design

• Here's an article that lifts the fog off of the not-so-tough problem of miscible-flood design. With an understanding of liquid-vapor systems, some good laboratory data, and a reservoir engineer's background, you, too, can put a successful miscible flood in operation. Here's how.

BY W. E. BRIGHAM AND J. N. DEW
Continental Oil Co., Ponca City, Okla.

J. N. DEW W. E. BRIGHAM

The authors conclude . . .

1. In a miscible flood, miscible conditions must be maintained, or the recovery could be drastically reduced.

2. Recovery efficiency in a miscible flood can be calculated by multiplying the vertical sweep, horizontal sweep, and displacement efficiencies in a manner similar to water-flooding calculations.

3. The proper slug size is probably the least-known parameter of miscible systems. But from present data, 5% of the hydrocarbon pore volume seems to be the minimum slug size to use. Laboratory tests may determine a more exact slug-size estimate for a particular reservoir.

4. The miscible process seems most attractive for low-viscosity oil in tight or water-sensitive reservoirs. In reservoirs that are good water-flood prospects, combination water-miscible flooding should be considered. Laboratory data are needed here also.

5. Economics of the miscible flood or the combination water-miscible flood must be compared with other secondary-recovery techniques—notably water flooding and gas injection. It is the responsibility of the reservoir engineer to study all these possibilities early in the productive life of the field. If miscible displacement looks promising, it **must** be carried out at a relatively high pressure. If primary production is almost gone, it may be too late.

THE AUTHORS are well qualified to discuss flooding programs. W. E. Brigham is research engineer in charge of the miscible-flooding group of Continental's production research division. He joined Continental in 1958 after serving 2 years as instructor of chemical engineering at the University of Oklahoma, where he received his MS in 1956. John N. Dew is supervising research engineer in charge of Continental's recovery-processes section, and has been with the production research division since 1953. Before that, he was associated with the research and development division of the New Mexico School of Mines. He holds a PhD in chemical engineering from the University of Michigan.

THERE ARE three types of miscible floods: (1) vaporizing gas drive, (2) condensing gas drive, and (3) miscible slug.[1 2 3 4]

Vaporizing gas drive or high-pressure gas drive. This consists of injecting a lean gas into a high-pressure reservoir. As the injected gas contacts the reservoir liquid, C_2 through C_6 intermediates in the liquid are vaporized into the gas. The gas front becomes more and more enriched with intermediates until soon it is miscible with the reservoir liquid. From then on the displacement is miscible. This process is easily seen visually by use of the ternary diagram, Fig. 1.

A ternary diagram for reservoir fluids is not thermodynamically rigorous, but it is useful to represent what is going on in a reservoir. In the case of the vaporizing gas drive, the injected gas composition would be represented by point A of Fig. 1, and the reservoir liquid composition by point B. As the gas front contacts reservoir fluid it will be enriched along the vapor line V_1-V_2-V_3 until the composition reaches point O, the critical point, at which time the system is miscible (as seen by the fact that a line between O and B all lies within the single-phase, or miscible region). The displacement from then on is miscible.

Meanwhile, the oil around the injection well has been denuded of its intermediates along the liquid line L_3-L_2-L_1, and this small amount of liquid is lost to recovery since it will never reach a miscible condition.

From the composition of point B on the diagram (high in intermediates and fairly low in C_7+) we can see that this reservoir fluid would be classified as a volatile oil. It can be said, probably without exception, that vaporizing gas drive can only be used with high-pressure, volatile oil reservoirs.

Let us suppose that the reservoir oil instead of having composition B has

Presented at Advanced Petroleum-Engineering Seminar, University of Oklahoma, Norman.

composition C—still a volatile oil. In this case, a lean gas, A, will enrich as before, but only to composition V_2. In the meantime, the reservoir liquid will approach composition L_2 along the same equilibrium tie line. These tie lines are defined by the equilibrium ratios (K values) of the various components and by the composition of the fluids. In short, we will never reach miscibility with these fluids at these operating conditions.

How is miscibility achieved? One way would be to raise the pressure in the reservoir. For as the pressure increases the two-phase region gets smaller; the critical point, O, moves to the left, and eventually the two fluids become miscible. However, raising the reservoir pressure is often not practical. There is the danger of pressure parting, and raising the pressure is both costly and time consuming. So, a simplier method for achieving miscibility is needed, and the condensing gas drive enters the picture.

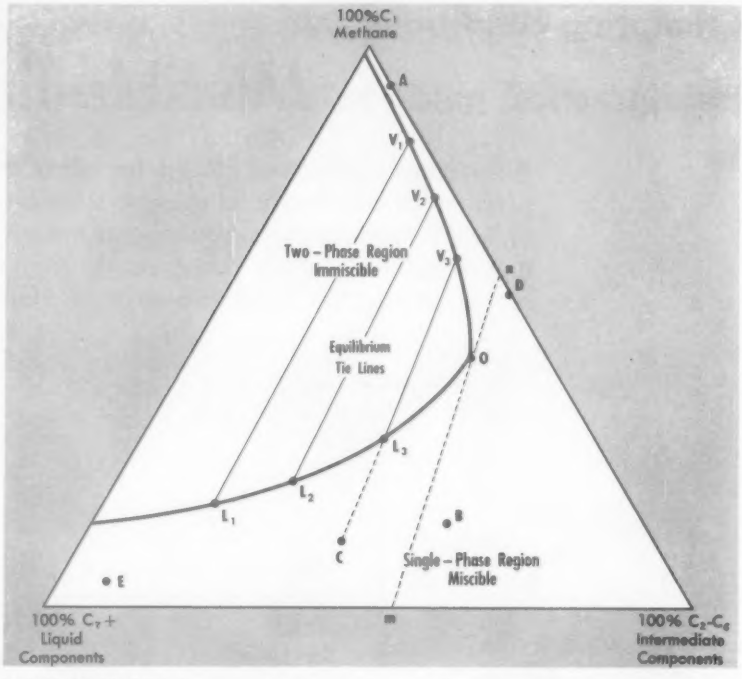
Condensing gas drive. Let us again assume a reservoir liquid of composition C, but now inject a rich gas of composition D, Fig. 1. In this case, the intermediate components from the rich gas condense into the liquid so that the liquid around the injection well bore becomes enriched in intermediates along the liquid line L_1-L_2-L_3 until the liquid composition reaches point O. From that time on the enriched liquid is miscible with the injected gas.

Note that in this case it is not necessary for the oil to be a "volatile" oil. It may, for instance, have a composition such as point E, which is very low in intermediates. Of course, with a reservoir oil like E a greater volume of rich gas would have to be injected before the miscible condition is achieved since more enriching of the reservoir oil is necessary.

What is it that forces one to use a condensing gas drive in one case while a vaporizing gas drive can be used in another?

Notice the line m-n. This line is drawn tangent to the two-phase curve through the critical point, O. It may also be considered an extension of the equilibrium tie lines as they approach the critical point. Once this line is drawn we see that one of the fluids (either liquid or gas) must have a composition such that it falls to the right of line m-n. That is, one of the fluids must be very rich in the C_2-C_6 intermediates.

If the reservoir oil is rich enough, such as oil B, then the gas can be "lean" as in gas A, and a vaporizing gas drive is permissible. If the oil is too lean, as in oils C or E, the gas must be enriched, as in gas D, and a condensing gas drive is used.



PHASE RELATIONS for vaporizing gas drive and condensing gas drive. Fig. 1.

Which of these methods will work? The only sure way to know is with a thorough PVT analysis of the reservoir fluid mixed with gas. It is possible using existing correlations[5,6] to approximate the composition needed or the type of miscible drive possible, but only laboratory work can give an accurate answer as to compositions needed. It should be emphasized that this laboratory work is necessary, for if the system is not miscible the ultimate oil recovery is much less. This point alone is enough to make or break the project financially.

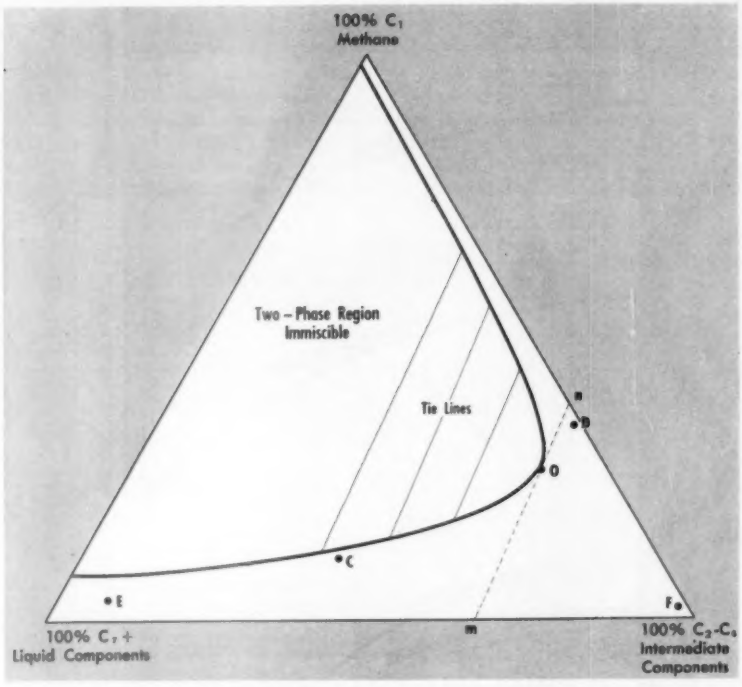
So far, we have discussed reservoirs that may be at pressures in the order of 3,000 psi. and higher. Let us see what happens to the ternary diagram if the reservoir is at a lower pressure, Fig. 2.

Notice that the two-phase region is much larger. To attain miscibility (as determined by line m-n) a greater proportion of intermediates must be present. And, if pressures get even lower the two-phase region will be larger. With a reservoir liquid such as C or E an enriched gas of composition D, Fig. 2, would be proper to use. Only it is hardly proper to call fluid D an enriched gas; rather it should be called an LPG mixture diluted with gas since it is primarily C_2-C_6. Since the C_2-C_6 intermediates are nearly as expensive as oil, it is just a matter of logic to follow this LPG mixture with a cheap, lean gas, such as "A" in Fig. 2.

Hence the name miscible-slug process. A slug of LPG is injected, often with a composition like point F, and followed by lean gas. Note that the miscible-slug process is really much like the condensing gas-drive process. The only difference is the amount of enriching intermediates in the slug, for it is also economically attractive to switch from rich gas to lean gas later in the life of the condensing gas drive. So, in this case, there is a slug of rich gas, rather than a slug of LPG.

At how low a pressure can we have a miscible flood? There is no single answer to this question, for this minimum miscible pressure depends on (1) what enriching fluids are available, and (2) the reservoir temperature. Fig. 3, which shows the critical pressures at various mixtures, will illustrate this point. These critical pressures are also minimum-miscibility pressures.

Let us assume we have a reservoir temperature of 160° F. and have a supply of butane available for a miscible slug. We wish to chase this with a dry gas of nearly pure methane. According to Fig. 3 the minimum allowable pressure is about 1,810 psia. Below this pressure miscibility will not be achieved between the butane and the gas. However, if propane is used in the slug, the minimum operating pressure drops to 1,020 psia. In actual practice the injected LPG will probably be a mixture of propane and



MISCIBLE-SLUG DRIVE shows these phase relations. Fig. 2.

butane and the gas chasing it will contain some ethane and heavier. So, the minimum miscible pressure must be determined for each specific case.

Here's an example of a very low permissible miscible pressure in one of Continental Oil Co.'s fields in Wyoming.[7] This field is near a gasoline plant. The deethanizer overhead from this plant is about 60% methane and 40% ethane. By using a slug of propane followed by a slug of this ethane-rich gas we are able to achieve miscibility at 790 psia. at the reservoir temperature of 180° F. An approximation of the critical curve for this system is shown as a dotted line on Fig. 3. Probably this dotted line approaches the practical low limit of miscible displacement pressure, and this low limit is based on the assumption that an ethane-rich gas stream is available.

In this case we have a multiple-slug process of propane, followed by rich gas, followed by lean gas. For economic reasons most miscible floods will use lean gas as the final scavenging fluid.

The importance of achieving miscibility cannot be overemphasized. To assure that the system is miscible, laboratory data should almost always be run on the two important fluids—the fluids whose minimum miscibility pressure controls the operating pressure.

Thus in a condensing gas drive, miscibility data are needed on the rich gas and the reservoir liquid; in the miscible-slug process, data are needed between the LPG slug and the gas chasing it. This type of data is always fairly expensive, but it is cheap insurance, for if miscibility is not achieved, the process may be little better than ordinary gas injection.

Vertical Coverage

In most reservoirs there are streaks of both high and low permeability; and often these streaks can be traced from well to well. If a reservoir is stratified, some zones, because of their low permeability, will not be swept by the invading fluid. The effect then is that the vertical sweep efficiency is low.

These questions arise: (1) what vertical sweep efficiency can we expect with a miscible flood and (2) how will mobility ratio affect vertical sweep?

Here's an example. Picture two strata, one with 100-md. permeability, and the other with 200-md. permeability. Let us first inject a fluid with the same mobility (k/μ) as the oil in these strata. The mobility ratio is then 1.0, which might be called typical of water-flooding mobilities. It is apparent that the injected fluid will go into the 200-md. streak twice as fast as it goes into the 100-md. streak, and the injection will continue at this ratio of 2:1.

Again, let us take two strata at 200-md. and 100-md. permeability. This time we inject a fluid with a higher mobility than the in-place oil. The mobility ratio in this case is greater than 1.0, which is typical of a miscible flood. As the fluid is injected, at first it will go into the 200-md. streak twice as fast as in the 100-md. streak—as before. But, visualize what happens as this 200-md. streak becomes filled with invading fluid while the tight streak still contains much of its original oil.

The invading fluid has a high mobility (it moves more easily than the oil), so the flow rate in the 200-md. streak accelerates rapidly. The 200-md. streak essentially becomes a "super highway," and less oil is recovered from the tight streak than before.

The effects of permeability stratification can be calculated for any given mobility ratio, and one such series of calculations is shown in Fig. 4 for a radial system. The degree of permeability stratification is expressed in term "permeability variation" (V), as used by Dykstra and Parsons.[8] V has the value 0.0 for a homogeneous reservoir, and the value 1.0 for a reservoir with infinite variation. Most stratified reservoirs have a V of between 0.6 and 0.65.

As we have deduced above, the coverage, C, (the vertical sweep efficiency) decreases as mobility ratio increases. Note that the curves in Fig. 4 are for a radial system, while the original Dykstra and Parsons curves were calculated for the linear system. Dykstra and Parsons' linear calculation unduly penalizes high mobility ratios, compared to radial flow calculations.

Fig. 4 is shown at a production ratio of 25 bbl. excess fluid per bbl. reservoir oil. If we were calculating a water flood, this term would be 25 bbl. of water produced per barrel of reservoir oil produced.

For a miscible flood it is necessary to change the producing gas-oil ratios and LPG production back to reservoir conditions as barrels of free gas plus barrels of LPG being produced with each barrel of reservoir oil. For these calculations, along with the producing GOR's and separator conditions, it is necessary to know the formation volume factors for oil, gas, and LPG and the solution GOR's.

Notice that no data are given for mobility ratios greater than 100:1. This is because at a higher ratio the over-all sweep efficiency will probably be too low for a miscible flood to be economically attractive. Since the effective mobility ratio is the inverse viscosity ratio between the oil and the scavenging gas, it is easy to estimate the permissible oil viscosity for a miscible flood. Injected lean gas has a viscosity of about 0.02 cp. at reservoir temperatures. With maximum

permissible viscosity ratio at 100:1, the maximum reservoir oil viscosity is about 2.0 cp.

Areal Coverage

In a developed flood pattern, the area swept from the pattern will be a function of the mobility ratio of the flowing fluids and the amount of fluid injected. Fig. 5 shows the areal sweep efficiency for a 5-spot pattern as a function of mobility ratio and a term "ψ" which we can call "fraction of excess fluid producing." In a water flood this term is the water-cut fraction. But, in a miscible flood the term ψ expresses what fraction of the fluid being produced is **not** reservoir oil. Thus ψ is the volume of gas plus LPG in barrels being produced at reservoir conditions for each barrel of total fluid (gas, LPG, and oil) produced.

Note that the lines are dotted for mobility ratios from 10 to 100. The solid portions of the lines are from data by Dyes, Caudle, and Erickson,[9] and these dotted portions are extrapolated from that data. Nearly all miscible floods would be operated with a mobility ratio lying within the extrapolated portion of these curves, so the calculated areal sweep efficiency will not be as accurate as desired.

This is an area of study that will probably be the subject of future research. The data are badly needed for miscible-flooding work, for fire flooding (where mobility ratios are high) and for water flooding of high-viscosity crudes.

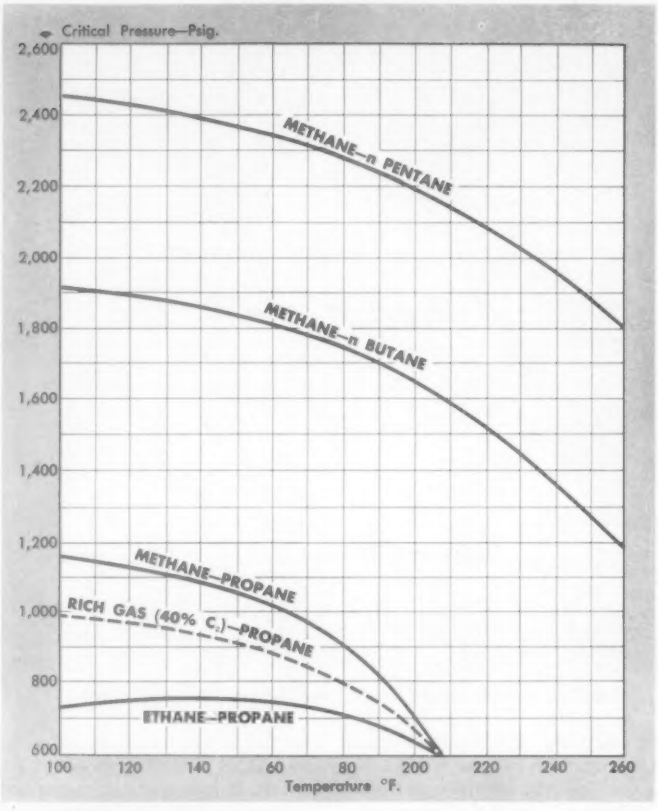
Total Recovery Efficiency

The reservoir engineer will recognize that the methods shown for calculating the areal, vertical, and displacement efficiencies are similar to the usual water-flood calculations. Also, as in water flooding, the total recovery efficiency may be approximated by multiplying the displacement efficiency by the areal and vertical sweep efficiencies.

Fig. 6 shows this concept in a pictorial form for a miscible flood, compared to a "typical" water flood—both at breakthrough.

The miscible flood has a displacement efficiency of 100%, or a residual oil saturation of 0%, while the displacement efficiency of the water flood depends on the lithology of the formation. In this case, we assumed the original water saturation was 25% (oil saturation 75%) and the residual oil saturation after water flooding was 30%. Thus the waterflood displacement efficiency was 60%.

Notice that both the areal sweep efficiency and the vertical sweep efficiency are lower for the miscible flood (mobility ratio = 25) than the water flood (mobility ratio = 1.0). Thus, at breakthrough in this stratified reservoir the miscible flood recovered about 9% of the oil in place, while the water flood recovered about 19% at breakthrough.



MISCIBLE PRESSURES for hydrocarbon mixtures as a function of reservoir temperatures. Fig. 3.

This type of calculation can be carried on after breakthrough for the entire life of the project. The results of one series of calculations are shown in Fig. 7. The miscible flood breaks through sooner than the water flood, but will eventually recover more oil than the water flood due to recovery after breakthrough—even for the case illustrated here, which is a good waterflood prospect.

Low recovery at breakthrough with a large amount of subordinate production might be considered typical of miscible floods. It is important to realize this, for a number of field projects which have exhibited early breakthrough have been regarded as failures, when in fact early breakthrough should be expected, as shown by the above calculations and by the producing history of a number of field floods.

Consider separation equipment. Since a large percentage of the production from a miscible flood will come after LPG and gas breakthrough, it is well to consider the surface separation equipment for maximum recovery of liquids. A large volume of gas will be cycled through the reservoir to wash out all the LPG and oil possible and this cycled gas will carry appreciable quantities of hydrocarbon liquids in the gaseous state. If the flood is carried out near a gasoline plant it is usually good economics to gather as much of the separator gas as possible for processing in that plant. If no plant is near, other techniques for maximum recovery of liquid (such as low-temperature separators and field stabilizers) should be considered.

Combination Water and Miscible Flooding

A fairly recent development in miscible-flooding theory is the idea of a combination (or simultaneous) water-miscible flood.[10] The theory is that it would be possible to combine the advantages of the high displacement efficiency of a miscible flood with the high sweep efficiency of the water flood by injecting both water and miscible fluids into the reservoir. Laboratory data indicate that this technique may have a lot of merit.[11]

The sweep efficiency to be expected from a combination flood like this should be nearly as good as water-flood sweep efficiencies; and although the displacement efficiency will probably not be 100%, as in an ordinary miscible flood, it will be considerably better than water-flooding displacement efficiency.

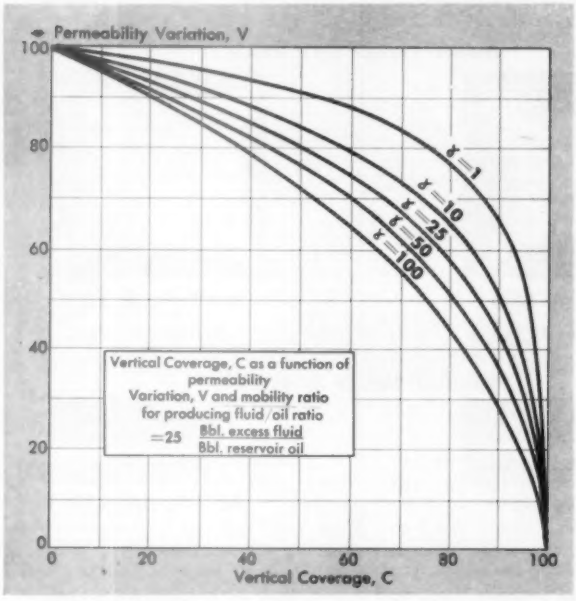
Fig. 7 shows the result which might be expected for a combination flood. The mobility ratio for the combination flood was assumed to be 1.0, and the residual oil saturation 7.5%, compared to a residual oil saturation of 30% for the water flood. Note that for this case the combination flood recovers more oil than either the water flood or the ordinary miscible flood.

It recovers more than the water flood because of the higher displacement efficiency, and more than the miscible flood because of the improved mobility ratio and thus improved horizontal and vertical sweep efficiencies.

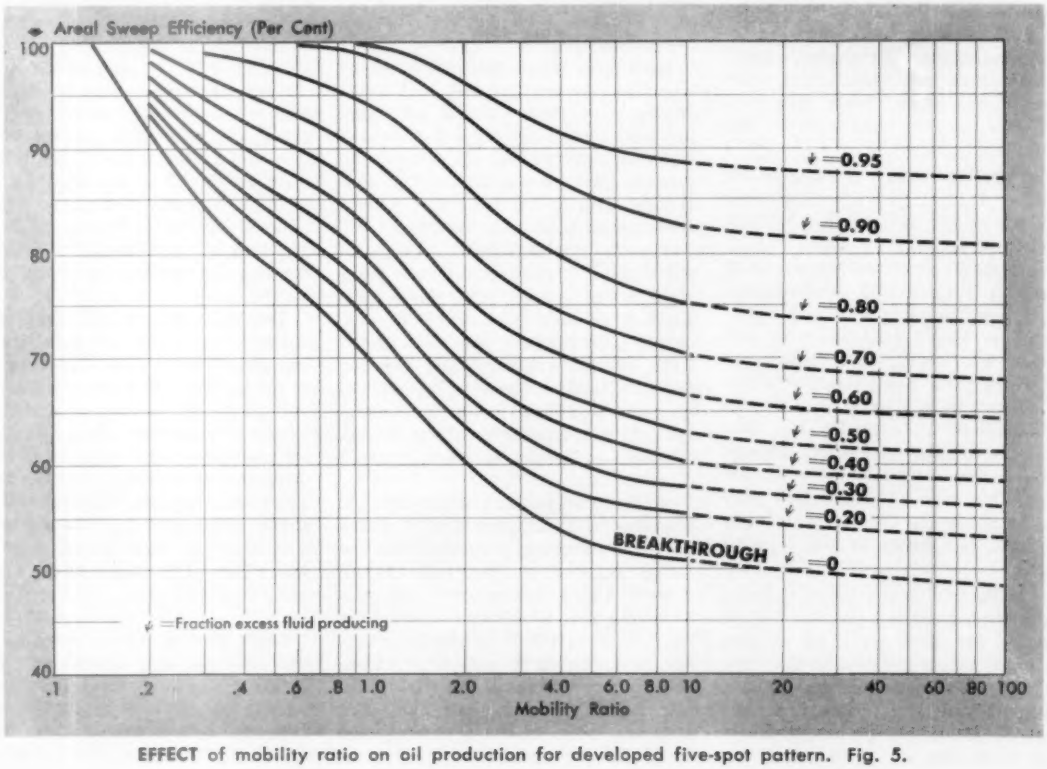
Where would it be best to use a combination flood, as compared to an ordinary miscible flood? Usually, a miscible flood has the best potential in either a low-permeability reservoir where water-flooding rates would be too low to be attractive, or in a water-sensitive sand or other formation where the water-flood displacement efficiency would be low.

In any case, we would like to have a low oil viscosity so that sweep efficiencies will be reasonably high. In other words, we are trying to take advantage of the high mobility and high displacement efficiency of a miscible flood and minimize the disadvantages caused by this high mobility.

If the reservoir is dipping, the miscible flood is a particularly suitable recovery technique. The LPG and gas may be injected updip and the oil driven down. Using this method, gravity effects tend to minimize the unfavorable mobility ratio of the miscible flood.



RADIAL-FLOW PREDICTION of oil recovery by water or miscible flooding. Fig. 4.



EFFECT of mobility ratio on oil production for developed five-spot pattern. Fig. 5.

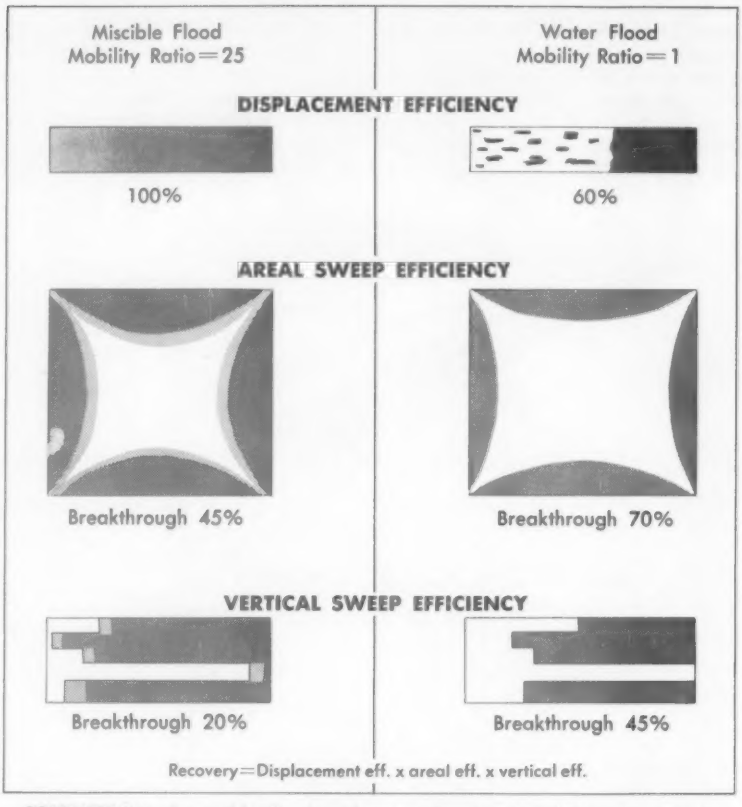
Volatile oil reservoirs with condensate gas caps are a common occurrence in Texas, Louisiana, and offshore. During primary production the gas-cap pressure is often drawn down faster than the pressure in the oil column, resulting in migration of oil into the gas cap. The most efficient method of recovering this oil is the miscible flood. Further, since the gas adjacent to the oil is already a rich condensate, little enriching of this gas is necessary to build up a miscible system, and the cost is correspondingly low.

In a combination (or simultaneous) flood the mobility of the injected fluids is deliberately lowered in order to increase the sweep efficiency. For this reason, we will need fairly high injectivity, and the viscosity of the oil is not nearly so important. In short, any reservoir which is a good water-flooding prospect may be an even better combination-flood prospect. The criterion is whether or not the residual-oil saturation after combination flooding is enough lower than the residual-oil saturation after water flooding to justify the additional expense of injecting two fluids. This must be determined for each reservoir using laboratory data.

It is important to know what LPG-to-water or gas-to-water ratio is needed to operate a combination flood efficiently. Caudle and Dyes[10] have devised a theoretical injection criterion which has been borne out in laboratory tests. If water and LPG are injected simultaneously, the ratios should be such that the velocity of each phase is the same. Thus they will both flow at the same rate in the reservoir.

The relative velocity of water is defined as k_{rw}/μ_w $[1/(S_w - S_{wi})]$ and correspondingly the relative velocity of LPG is k_{rLPG}/μ_{LPG} $[1/(1 - S_w)]$. The relative permeability of each phase (k_r) is a function of saturation, so it is possible using relative permeability data and a trial-and-error calculation to find a water saturation (S_w) which gives equal relative velocities. Once this is determined, the injected volume of each fluid is proportional to the saturation change ($S_w - S_{wi}$ for water, and $1 - S_w$ for LPG). This type of calculation may also be made in the same manner using gas and water as the injected fluids.

It should not be concluded that the combination flood is a panacea for oil recovery, for there are a lot of production problems involved in this type of flood. For instance, after breakthrough, hydrate formation is possible for LPG, gas, and water are produced along with the oil. And, near the end of the producing life, GOR's and water cut will be high.



COMPARISON of miscible flood and water flood at breakthrough. Fig. 6.

Slug Size

How large a miscible slug must be injected between the oil and scavenging gas? This question has been the motivating force behind most miscible-flooding research. But, as yet, no theories have been proven for all conditions, and no satisfactory general correlations have been developed.

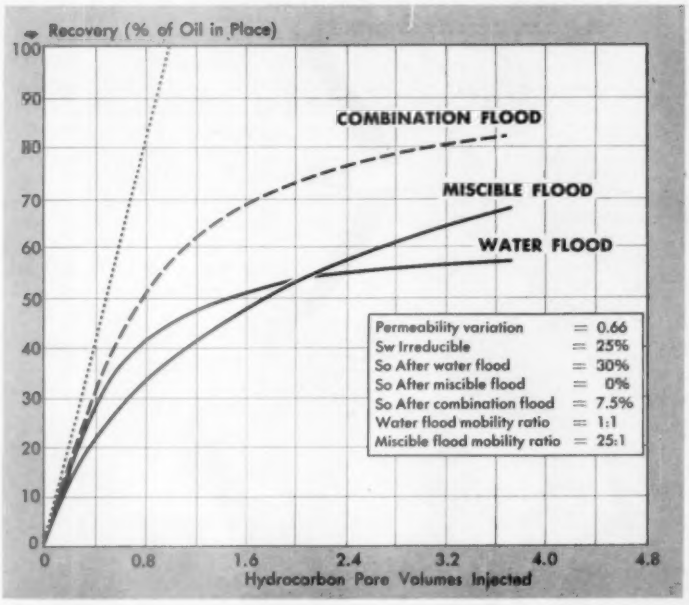
The slug size necessarily depends on the amount of fluid mixing that takes place in the reservoir, and this in turn depends on these factors: (1) the viscosity ratio between the oil and the LPG, (2) the viscosity ratio between the LPG and the scavenging gas, (3) reservoir stratification, (4) gas saturation, (5) well spacing (length of travel), (6) type of porous medium, and (7) flooding rate.

Some experimentors believe that the fingering or channeling that is found in small laboratory models can be scaled directly to reservoir dimensions.[11] Using this theory, one predicts that it is necessary to use a slug from 50% to 100% of the hydrocarbon pore volume to recover a reasonably large percentage of the oil in place. Another group has found that a mixed zone between the injected fluid and the reservoir oil will grow rapidly at first and then stabilize in length.[12]

Thus, because of the narrow width of this "stable" zone, a slug size equivalent to 0.2% or less of the hydrocarbon pore volume may be sufficient. Others have found that the width of the mixed zone will grow in proportion to the square root of the distance travelled,[13] and a slug size as small as 0.5% of the hydrocarbon pore volume is sufficient. Notice that these last two theories would predict that the slug size necessary is a function of well spacing.

The most recent laboratory data[14] indicate that each of these theories has some merit. The displacing LPG or gas does finger badly into the reservoir oil at first, causing a rapid growth of mixed zone, but this rapid fingering-type growth is soon slowed due to diffusion and mixing of the fluids. The mixed zone then becomes pseudo-stable, and from then on grows slowly according to the square-root law, which has been found to be valid at unity viscosity ratios.

Study needed. Two important variables have not been adequately studied in the laboratory: the effects of gas saturations and type of porous media. From the data available, there can be no doubt that the amount of mixing,



COMPARISON of calculated recoveries for developed five-spot pattern. Fig. 7.

and thus the slug size necessary, is a function of the reservoir rock characteristics.[15 17] The effects of original gas saturation have not been published, but there is general agreement that gas saturation will also affect mixing.

To accurately predict the slug size needed, the best procedure is to run displacements in a laboratory core or sand pack using the actual gas, LPG, and reservoir oil that will be used in the proposed project. These displacements should be run at the reservoir pressure, temperature, and gas saturation expected at the time the flood is initiated. The core should be long enough to establish the length of the pseudostable zone and the rate of growth after pseudostabilization. The zone length is then scaled for reservoir stratification and well spacing.

The core or pack should be at least 1 in. in diameter since erroneous results have been found at smaller diameters.[14 15] Also, the porous medium should have the same mixing characteristics as the actual reservoir rock. A mixing coefficient (α) has been reported recently which can be easily determined on small reservoir cores.[15] It is an excellent criterion for matching a laboratory core or sand pack with the reservoir material, for if the materials have the same mixing coefficient (α) they will exhibit the same mixing characteristics.

. . . The reservoir engineer still needs to be able to estimate slug size without laboratory data, particularly for the first economic estimates. It is possible to consider the foregoing theories in light of field experience and arrive at a reasonable slug size range. A slug size of only 0.5% of the hydrocarbon pore volume is definitely not reasonable for a heterogeneous reservoir, for in order to inject a slug of 0.5% into the tighter strata, it may be necessary to inject 10 to 20 times that amount into the permeable streaks—this with only a normally stratified reservoir.

In the Millican Reef field in Texas a pilot-miscible flood was attempted using 2% of the hydrocarbon pore volume for slug size.[18] The slug was found to be too small, and miscibility was lost. Results of the pilot program indicate that a slug three to five times larger should have been injected.

On the other hand, a slug size equal to 50% of the hydrocarbon volume of the reservoir is also not needed as indicated from field evidence. Two pilot floods, one in the Bisti field in the Four Corners area[19] and one in the Pembina field in Canada,[20] have been successfully completed using 7% of the hydrocarbon pore volume for slug size. Both of these pilot floods recovered a large percentage of the oil in place. Indications on the Pembina pilot are that 7% was larger than needed for the flood.

Any answer which gives an absolute number, will be open to argument by the reader; but from the field results so far, one should consider 5% of the hydrocarbon pore volume the smallest slug size to use. Of course, this value will be more firmly fixed as subsequent laboratory and field data become available.

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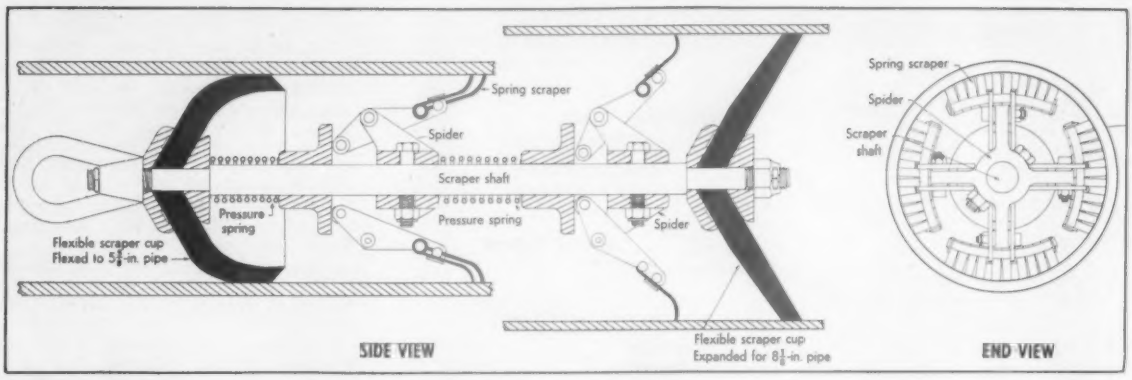
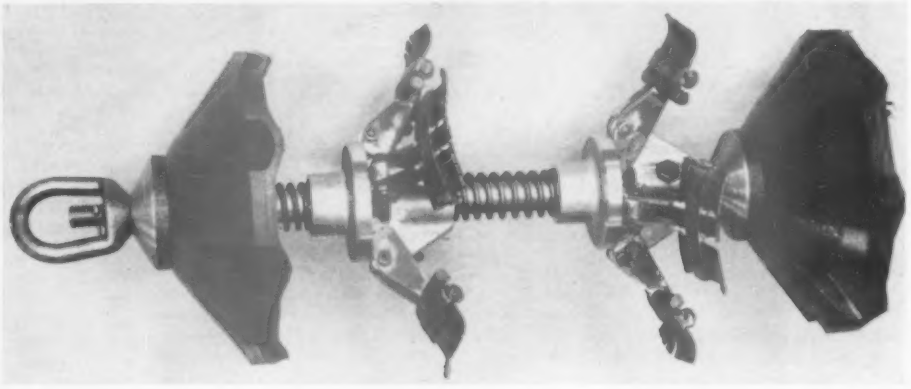


SMALLER SIZES (3-8-in.) have solid body. Pivotal arms press steel-spring cutting knives against the pipe wall. Figs. 1 and 2.



This new variable-diameter

Pipeline scraper saves $200,000

THE NEW variable-diameter scraper developed by Service Pipe Line Co. is much more than just an improved tool for doing better work on regular schedules of routine operations. The company deliberately set out to devise a radical innovation which would make possible a sweeping change in scraper routines. On the first project for which it was designed, more than $100,000 was saved by omitting scraper-trap facilities which the new scraper made unnecessary.

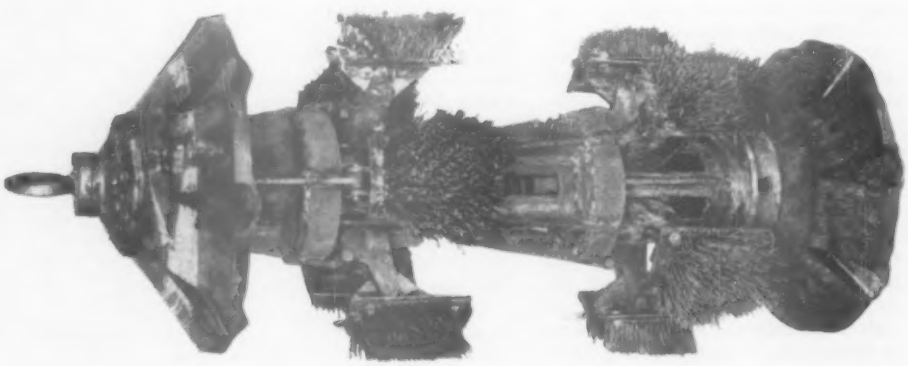
Altogether, more than $200,000 has been saved in capital expenditures in less than 2 years since the new scraper was introduced. This was done by omitting scraper traps which ordinarily would have been required for several projects handled in that period.

BY PAUL REED
Pipeline Editor

Unusual features of design include:

1. A compact frame on which a compression spring and a set of radial arms are mounted near the forward end, and an identical spring and set of arms mounted on the rear. These compression springs actuate the pivotal arms and hold narrow individual steel-spring cleaning knives firmly against the interior of the pipe wall with a force sufficient to hold the scraper body in the axis of the pipe.

2. Cone-type segmented propelling cups positioned on the front and rear of the frame propel and guide the unit in passing through gate valves and connections installed on the pipeline. A wire mesh is molded into the wearing surfaces of the propelling cups to increase service life.



INTERMEDIATE and larger sizes (8-24-in.) have tubular body with parallel linkage. Eventually steel-spring knives will supplant brushes on such tubular-type scrapers. Fig. 3.

3. The narrow individual steel-spring cleaning knives have proved to be superior to the conventional scraper brush for removal of paraffin, iron oxides, and other materials from the pipeline.

4. The smaller types—3-4 in., 4-6 in., and 6-8 in.—have a solid body shaft with pivotal arms (Figs. 1 and 2), whereas the intermediate and larger sizes—8-12 in., 12-18 in., 16-20 in., and 18-24 in.—have a tubular body with parallel linkage to actuate the arms (Fig. 3).

5. Since the scraper follows the axis of the pipe, a uniform pressure is applied on the top, bottom, and sides of the pipe, which insures thorough cleaning and uniform wear on the propelling cups.

6. Although the scraper is designed for multiple-size lines, it is satisfactory for single-size service.

NEW-TYPE CAST-STEEL WYE with shorter throat to facilitate passage of scrapers where two streams converge. Fig. 4.

Development

In 1957, Service Pipe Line Co. decided to bear down on the long-standing problems of variable-diameter scraper design. Something had to be done. At that time, when tying in a new 24-in. loop to an existing 18-in. line, the company was immediately faced with an expected expenditure of approximately $100,000 for scraper traps, valves, etc. (plus the high cost of acquiring valve sites in a very congested area) unless a satisfactory variable-diameter scraper for these sizes of pipe could be procured.

The company needed a scraper that would function over a wider range of diameter with less wear than was characteristic of the variable-diameter scrapers then being run by the industry.

The first move was to review and improve on the design of a 12-16-in. pilot model of the variable-diameter scraper built in 1954. This scraper utilized a longer body with a U-joint between the front and rear cleaning mechanisms. It was found advisable to design a cone-type segmented propelling cup to replace the dual-disk notched-type propelling mechanism.

By using a basic feature of the old "go-devil" scrapers—the compression spring—actuating a plurality of arms—and by the adaptation of pivotal and parallel linkage to transmit the spring action, a radically different conception of a singlebody variable-type scraper was developed.

Testing. Extensive tests have proved the compact single-body type of scraper to be well adapted to following the axis of a pipe. Its cleaning efficiency has demonstrated its value. Recently, runs have been completed satisfactorily on more than 2,000 miles of pipe in a wide range of diameters from 4 to 24 in. Most of the diameters in these tests have been 20, 22, and 24 in.

Particularly conclusive were the November 1959 tests on the 650-mile Drumright, Okla., to Manhattan, Ill., section. These showed that two variable-diameter scrapers could do work formerly requiring six conventional scrapers. The work of cleaning the scraper and replacing parts, also maintenance crew time in handling scraper runs, have been correspondingly reduced.

Operation. During the running of the 18-24-in. variable-diameter on November 18 and 19, 1959, flow was increased 400 bbl. per hour, and the differential pressure was decreased 17 psi.

Versatility is exemplified in one operation where it was necessary for the scraper to go through four 18-in., 90°, 10-ft.-radius bends. Without a variable-diameter scraper, it would have been necessary to install two new scraper junctions with crossover barrels and a number of gate valves for running a conventional scraper through the combination 18-24-in. line in this section of the pipeline system.

Advantages. Pipeline efficiency has been increased by the variable-diameter scraper, not only as the result of more thorough cleaning, but also by minimizing delays caused by the work of changing scrapers at traps. These delays interfere with the flow of the stream.

Reduction in labor requirements at station scraper traps and at traps located between stations make labor available for assignment to other duties.

Cast-steel wyes. It has long been a practice of pipeline companies to use wyes—either made of cast iron or fabricated from pipe by welding. These connect two parallel lines into a single line at intermediate locations between pump stations. Generally, these fittings have not been dependable, as failures have occurred due to mechanical stresses and pulsations. Also, the large area at the junction in these long-throated fittings gave opportunity for scrapers to lodge where the two streams converge.

In conjunction with the program of eliminating scraper traps and junction houses, which are unnecessary with the variable-diameter scraper, Service has designed cast-steel wyes with a short throat in three sizes, 10, 12, and 16 in. These were built and thoroughly tested at its Tulsa shops prior to installation at several locations on the system. Old scraper junctions installed as early as 1928 are being abandoned (Fig. 4).

Developers. A team of five men headed by A. M. Hill, superintendent of line maintenance, developed the new variable-diameter scraper within the Service Pipe Line organization. Hill conceived the basic ideas. These were amplified by the collaborators concerned with the various phases of the undertaking. The group includes: James S. Hartshorn, administrative assistant to Hill; James Fugate, engineer; and John Tomer and Tony A. Mass, senior design draftsmen.

With the conclusion of a successful testing program of the new variable-diameter scrapers, it is evident that they will have broad application in pipelining. Service is considering applications from firms interested in a license for commercial manufacture and sale of these tools.

Slim-hole completions reduce well costs 35% . . . so reports Hudson's Bay, based on 36 wells drilled in Pembina field

ACTUAL COST DATA prove that Hudson's Bay Oil & Gas Co. saved an average of 35% by making slim-hole completions.

Maximum saving on the 36 small-diameter wells was 42% compared to conventional holes drilled with a half-mile radius in Pembina field. Median saving was 33%. When we compare the actual costs of all our slim holes to offset conventional holes, the result is a saving averaging 35%.

Our last conventional-size hole was drilled some time ago. In the meantime, many prices have changed. Cost of materials has steadily increased; on the other hand, price of drilling has decreased. As a result, it is possible that a fair comparison cannot be made between conventional holes then and slim holes now.

Still, when we make a theoretical cost comparison between slim holes and conventional holes using today's prices, the expected saving is at least 28%. Major portion of this saving is in materials.

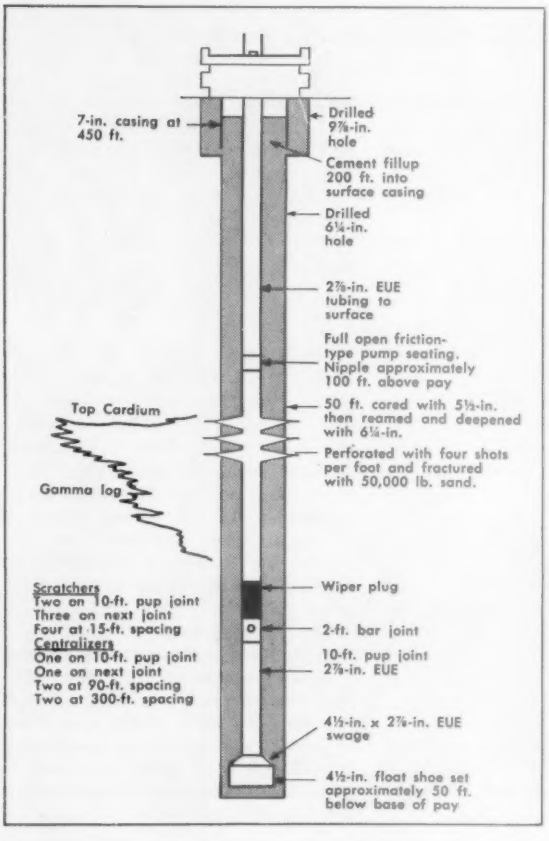
In our slim holes, we set 2⅞-in. tubing in 6¼-in. hole. This program has proved mechanically sound in that there has been no more trouble than might be expected. The slim holes have been produced in all conventional manners: pumping, intermittent (stop-cock) flow, and plunger lift. Moreover, we have even made "associated dual completions" where two strings of 2⅞-in. pipe are cemented side by side, in the same hole.

Marginal wells. As the boundaries of Pembina field extended, Hudson's Bay became burdened with fringe leases whose marginal reserves were uneconomical when completed with conventional methods. To find ways of making these leases pay, a two-well experimental program was launched in the fall of 1956. The purpose was to evaluate slim holes cementing 2⅞-in. tubing in 6¼-in. hole.

Results on these two experimental wells were rewarding. From them we evolved our program for drilling and completion of all future wells in Pembina field. The technique has also been used in other fields where water or free gas is no particular problem. Thirty-six slim holes have been

BY JAMES G. BONSALL
Hudson's Bay Oil & Gas Co., Ltd.,
Edmonton, Alta.

Paper at 1960 spring meeting of API Division of Production's Rocky Mountain District, Casper, Wyo., presented under original title: Slim Hole Completions Reduce Development Cost."


7-in. casing at 450 ft.
Drilled 9⅞-in. hole
Cement fillup 200 ft. into surface casing
Drilled 6¼-in. hole
2⅞-in. EUE tubing to surface
Full open friction-type pump seating. Nipple approximately 100 ft. above pay
Top Cardium
50 ft. cored with 5½-in. then reamed and deepened with 6¼-in.
Perforated with four shots per foot and fractured with 50,000 lb. sand.
Gamma log
Scratchers
Two on 10-ft. pup joint
Three on next joint
Four at 15-ft. spacing
Centralizers
One on 10-ft. pup joint
One on next joint
Two at 90-ft. spacing
Two at 300-ft. spacing
Wiper plug
2-ft. bar joint
10-ft. pup joint 2⅞-in. EUE
4½-in. x 2⅞-in. EUE swage
4½-in. float shoe set approximately 50 ft. below base of pay

SLIM-HOLE "tubingless" completion for Hudson's Bay Oil & Gas Co.'s Pembina field wells. Float shoe is 4½-in. because it acts as centralizer and is as cheap as smaller 2⅞-in. shoe. Fig. 1.

CEMENT STRINGERS prevented wireline tools from getting to bottom, on first of the wells cased with 2⅞-in. casing. These obstructions could be removed easily with spudders but were a hazard. After this wiper plug was used to displace cement, problem was eliminated. Fig. 2.

TABLE 1—ACTUAL COST COMPARISON BETWEEN SLIM HOLES AND CONVENTIONAL HOLES DRILLED ON THE SAME LEASE

Well name—	HB Alder Flats 10-8-47-6	HB Alder Flats 8-7-47-6	HB Alder Flats 12-8-47-6	HB Alder Flats 14-8-47-6
Date well completed	Sept. 1957	Mar. 1958	Oct. 1956	Sept. 1956
Total depth, feet	5,049	5,123	5,101	5,088
Type	Slim hole	Slim hole	Conventional drill	Conventional drill
Casing	$ 1,553	$ 1,854	$10,355	$10,476
Tubing	4,975	5,293	3,856	4,366
Wellhead	1,688	1,345	2,197	2,120
Misc. materials	845	1,217	730	1,720
Contract drilling and daywork	13,976	17,928	23,752	26,306
Company overhead expense	967	1,616	1,200	1,495
Trucking	1,300	1,365	817	1,714
Outside labor	152	190	383	402
Cementing	2,806	3,588	1,874	1,833
Acid	160	155	495	600
Logging	1,810	893	1,309	1,630
Perforating	987	395	600	638
Coring	140	.....	.....	300
Fracturing	3,193	3,790	5,817	5,747
Testing	.....	.....	.....	525
Analyses	98	51	.....	345
Location expense	2,459	2,818	2,642	4,250
Mud	1,046	1,189	558	1,125
TOTAL	$38,155	$43,687	$56,585	$65,592

TABLE 2—COST COMPARISON BETWEEN THEORETICAL SLIM HOLE AND CONVENTIONAL HOLE DRILLED TO 5,000 FT. IN THE PEMBINA FIELD

	Slim hole	Conventional hole
Casing	$ 1,300	$12,100
Tubing	5,300	5,300
Wellhead	1,100	2,200
Miscellaneous materials (Float equipment, centralizers, etc.)	800	1,200
Contract drilling and daywork	15,800	16,600
Company overhead expense	900	900
Trucking	900	1,800
Outside labor	120	120
Cementing	2,800	2,000
Acid	150	600
Logging	850	850
Perforating	450	350
Fracturing	3,300	4,500
Location expense	2,500	2,500
Mud	1,000	1,000
Core analysis	200	200
TOTAL	$37,470	$52,220

SAVING: $14,750 or 28%.

completed to date at depths from 2,600 to 6,900 ft.

There is no particular savings in actual drilling. When we started, rigs equipped for slim-hole work were not readily available and contractors bid equivalent rates for slim holes and conventional holes. Therefore, we will confine our discussion to completion technique, producing practices, and some related experiences.

We have modified the slim-hole technique further in dual-zone completions. This type of completion has been classified as an "associated completion" and cements two strings of 2⅞-in. tubing in the same hole. At the time of this paper three wells have been completed in this manner; not only are costs lower than conventional duals, but there is a definite operating advantage.

Well program. A typical well program for a slim-hole completion in the Cardium sand would be (see Fig. 1):

1. Drill sufficient 9⅞-in. hole to set 450 ft. on 7-in. surface casing.
2. Drill 6¼-in. hole to the top of the Cardium sand.
3. Cut a 50-ft. diamond core with 5½-in. bit.
4. Ream the rat hole with 6¼-in. bit and deepen hole sufficiently to set float shoe approximately 50 ft. below bottom perforation.
5. Run production string of 2⅞-in. tubing with a 4½-in. float shoe, 4½ by 2⅞-in. swage, 10-ft. pup joint, and 2-ft. bar joint from the bottom up. Install a full-open friction-type pump seating nipple in the string approximately 100 ft. above the pay.
6. Cement with sufficient volume to bring the cement top 200 ft. into the surface casing, displacing the wiper plug with 1 bbl. of oil, 250 gal. of acid, and the remainder oil.
7. After 6 hours waiting on cement, bleed off pressure and head up.
8. Release rig.
9. Run gamma ray-neutron log and, after a minimum 24 hours WOC, perforate the selected interval with four shots per foot.
10. Squeeze acid into formation and after a minimum of three hours' reaction time, fracture formation with designed volume.

For wells completed in a formation not requiring fracturing, wiper plug is displaced with oil only.

Production-string. The production string from bottom upward is:

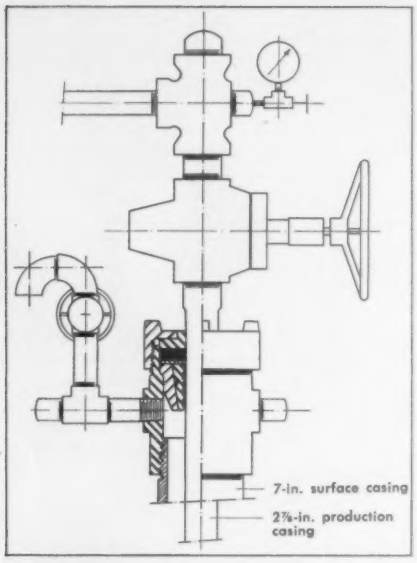
1. One 4½-in. float shoe.
2. One 4½ by 2⅞-in. EUE swage.
3. One 10-ft. pup joint 2⅞ EUE.
4. One 2-ft. pup joint 2⅞ EUE with internal ½-in. steel crossbars welded securely.
5. 2⅞-in. J-55, 6.5-lb. per ft. EUE tubing to surface.

One centralizer and two scratchers are placed on the 10-ft. pup joint. One centralizer and three scratchers are placed on the first full joint of tubing, then four scratchers are placed at 15-ft. spacing and two centralizers at 90-ft. spacing. Two more centralizers are placed at 300-ft. spacing.

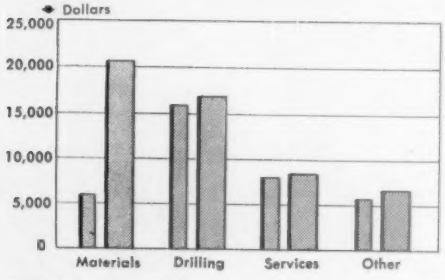
A 4½-in. float shoe is preferred over a 2⅞-in. float shoe for several reasons. First, the 4½-in. shoe has more port area for circulating, and second, it has a better centralizing effect. The 4½-in. shoe and swage are approximately the same price as a 2⅞-in. shoe.

The crossbars welded in the 2-ft. pup joint are a positive seat on which to bump the wiper plug. In laboratory tests at pressures up to 4,000 psi. the plug did not knock out the bars or deform enough to leak.

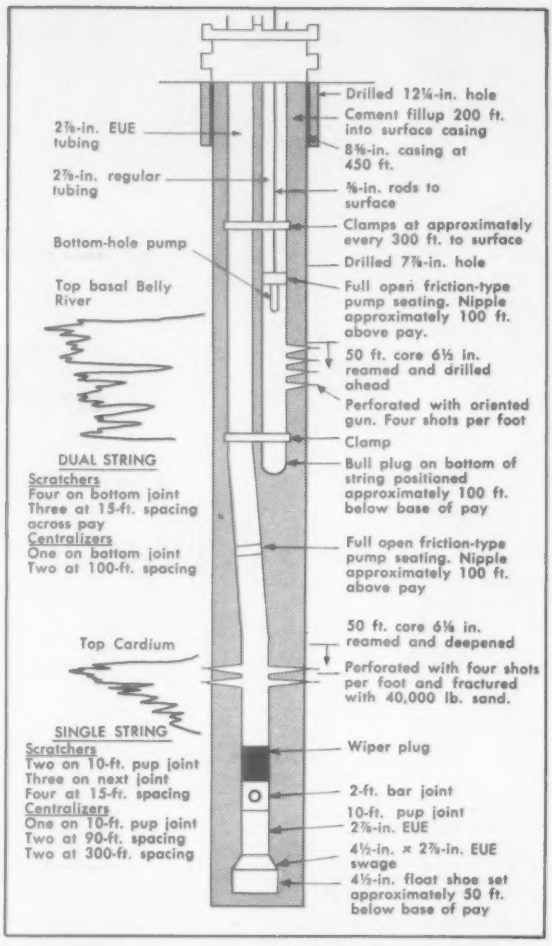
A full-open friction-type pump seating nipple is installed in the string approximately 100 ft. above the pay.



SLIM-HOLE WELLHEAD is simple, inexpensive. Master valve screws directly to tubing. Mistakes in measurement of tubing can be easily corrected after cementing by shortening top joint and rethreading or by lowering casing head. Fig. 3.



DRILLING SLIM HOLES is no cheaper than drilling regular-size holes. The savings come in materials. Fig. 4.


Drilled 12¼-in. hole
Cement fillup 200 ft. into surface casing
8⅝-in. casing at 450 ft.
2⅞-in. EUE tubing
2⅞-in. regular tubing
⅞-in. rods to surface
Clamps at approximately every 300 ft. to surface
Bottom-hole pump
Drilled 7⅞-in. hole
Top basal Belly River
Full open friction-type pump seating. Nipple approximately 100 ft. above pay.
50 ft. core 6½ in. reamed and drilled ahead
Perforated with oriented gun. Four shots per foot
Clamp
DUAL STRING
Scratchers
Four on bottom joint
Three at 15-ft. spacing across pay
Centralizers
One on bottom joint
Two at 100-ft. spacing
Bull plug on bottom of string positioned approximately 100 ft. below base of pay
Full open friction-type pump seating. Nipple approximately 100 ft. above pay
50 ft. core 6¼ in. reamed and deepened
Top Cardium
Perforated with four shots per foot and fractured with 40,000 lb. sand.
SINGLE STRING
Scratchers
Two on 10-ft. pup joint
Three on next joint
Four at 15-ft. spacing
Centralizers
One on 10-ft. pup joint
Two at 90-ft. spacing
Two at 300-ft. spacing
Wiper plug
2-ft. bar joint
10-ft. pup joint
2⅞-in. EUE
4½-in. × 2⅞-in. EUE swage
4½-in. float shoe set approximately 50 ft. below base of pay

ASSOCIATED DUAL COMPLETION is made by running two strings of 2⅞-in. strapped side-by-side. No more than usual troubles have cropped in producing these wells and they are easier to account for since no packer-leakage tests are necessary. Fig. 5.

On the first wells, pump seating nipples were not installed for fear they would be too much restriction for the wiper plug. However, laboratory tests proved that little additional pressure is required to pass a plug through a full-open seating nipple.

Cementing. Cementing specifications call for fillup into the surface casing. To do this, most of the cement is lightweight, high-yield. This is followed by a smaller volume of high-strength cement opposite the pay. The additional cost of bringing cement above the required top into the surface pipe is well justified because it provides rigid support and protection against external corrosion.

The cement is displaced with a wiper plug of special design (see Fig. 2).

When attempting to run logging tools on several of the first slim holes, there were minor obstructions in the tubing. These obstructions, believed to be cement stringers caused by poor wiping action, were easily removed by spudding with a sinker bar. However, they were a potential hazard so a new wiper plug was designed. It has been used exclusively and no obstructions have been encountered since.

If the wiper plug were displaced in the normal manner with mud, a trip in the hole with a macaroni string would be necessary to displace the pipe hole to oil and spot acid on bottom for fracturing. To overcome the expense of this additional operation, oil and acid are used to displace the plug. A barrel of oil and then 250 gal. of acid precede the oil used to displace the plug. The barrel of oil ahead of the acid simply provides an oil film on the pipe as an aid to the inhibitor in the acid to prevent attack on the pipe.

Immediately after the wiper plug bumps, pressure is bled off to test the float equipment. If the float holds, 200 psi. is held on it for 6 hours before bleeding off and landing the pipe. If the float is not functioning, a pressure equivalent to the differential between the two columns of fluid is left on the pipe for 6 hours. The float equipment is again tested to insure no bleed back before heading up.

Wellhead. The wellheads used for our slim-hole completions are compact and simple, as shown in Fig. 3. Landing the tubing "proud" eliminates the necessity of using a high-working-pressure housing since master valve connects directly to tubing string.

Landing depth of the tubing must be accurately determined so the slips may be set readily without leaving an excess of tubing protruding above the wellhead. If, however, either extreme arises, too much tubing pro-

truding because of hole sloughing or not enough because of mismeasurement, the remedy is quite simple. We have had both situations. In the first, excess tubing was cut off and rethreaded with nonupset threads; in the second, a ring was cut out of the surface casing to lower the tubinghead housing.

Logging and perforating. As mentioned earlier, we found minor obstructions in several of the earlier slim holes when we attempted to run logging tools to bottom. These obstructions were believed to be cement stringers caused by poor wiping during cementing.

In every instance a sinker bar removed the obstruction, but since the redesigned wiper plug has been used, no obstructions have occurred.

Laboratory tests were made to determine if acid in the hole would have any bad effect on perforating equipment. The tests showed no damage in a reasonable length of time. On one well, we had trouble with the collar locator and had to pull a gun that had been in the hole approximately 1 hour. The aluminum cotter pins locking the charges together were completely eaten away; however, there was no evidence of acid attack on the cast-aluminum charge bodies.

Fracturing. In the areas where slim-hole completions are most common, it is necessary to fracture the producing formation. Pretreatment with acid has proved very effective in reducing breakdown pressures and feeding pressures. To position the acid at the bottom of the hole, it is used as part of the displacement fluid following the cement wiper plug.

The pump truck is called to the lease 3 to 4 hours ahead of other equipment to squeeze acid into the formation.

There is controversy about the benefit of high fracturing rates. Such high rates are impossible in small-diameter-casing completions. Attempts to obtain feed rates greater than 10 bbl. per minute have simply resulted in excessive pressures with little increase in feed rate. Therefore, a pump truck of 600 to 900 h.hp. is sufficient.

Fracturing fluid is treated with a fluid-loss-reducing agent to extend the fracture. Gelling the fluid is not necessary to reduce sand falling rate because velocity of pumping (8 bbl. per minute) in the tubing is high. In the event of a sandoff, backwashing is not possible so temporary sand suspension is of no value.

Our average fracture treatment consists of 50,000 lb. of sand carried in crude oil treated with a fluid-loss-reducing agent. Concentrations average 2 lb. per gal. feeding 8 bbl. per minute at 3,200 psi.

Pumping equipment. Pumping equipment has been installed on eight slim holes up to this time. Six of these are earlier wells without pump seating nipples in the string. Packer-slip-type pump holddowns have been used and, where possible, adapted as top holddowns on RLA pumps. The other two have friction-cup top holddowns.

The only deviation from conventional pumping installations (i. e., tapered rod strings with blade-type scrapers) has been use of shear-pin sucker-rod safety joints in the rod strings immediately above the bottom-hole pump. If a pump becomes stuck in the hole, the safety joint can be sheared and the rod string removed. A macaroni string may be run in to circulate the hole clean to the pump. It is then possible to pull the pump with an overshot and jars.

In the pumping installations, we considered carefully the possible hazards and some of the preventive measures we could take. Most of these measures, such as hollow sucker rods, cost extra contrary to our initial objective to reduce costs. Therefore, to complement the whole slim-hole program, it has been our policy to use standard equipment unless necessity demands otherwise.

Other producing equipment. Both intermitter and plunger-lift installations have been made on slim holes. This equipment has been successful in eliminating wire-line dewaxing and curbing increasing gas-oil ratios. Without an annulus to provide a gas source, it is necessary to add a small gas-volume tank mounted on the flow tee. This tank stores gas at shut-in wellhead pressure each cycle and operates the diaphragm valve.

Associated completions. The slim holes have been further modified and applied to "associated completions." This is a form of dual-zone completion where two parallel strings of 2⅞-in. tubing are cemented in the same bore hole. This distinction from a dual-zone completion is given by the Oil and Gas Conservation Board of Alberta. Semiannual segregation tests required in dual-zone completions are not necessary in associated completions.

Associated completions were designed for the east edge of Keystone field which has two productive sands. The Cardium, the lower sand, is very thin and not economic to develop on its own.

The well program for an associated completion (see Fig. 5) is:

1. Drill 12¼-in. hole and set 450 ft. of 8⅝-in. surface casing.
2. Drill 7⅞-in. hole to total depth, cutting 6½-in. 50-ft. cores through the basal Belly River at approximately 3,100 ft. and the Cardium at approximately 4,100 ft.
3. Run open-hole logs.
4. Run two strings of 2⅞-in. tubing (long string, EUE—short string, regular) putting the float equipment and bar joint on the long string and a bull plug on the bottom of the short string. Position the bottom of the short string 100 ft. below base of the Belly River pay. Clamp the two strings together at bull plug, at collar or next joint, then at 300-ft. spacings to surface. Full-open friction-type pump seating nipples are placed in each string approximately 100 ft. above the pay.
5. Cement down the long string with enough volume to fill up 200 ft. into the surface casing. Follow the wiper plug with 1 bbl. of oil, 250 gal. of acid, then the remainder oil. Fill the short string with oil.
6. After 6 hours WOC, bleed off pressure and head up.
7. Release the rig.
8. Run gamma ray-collar log. Perforate the short string with an oriented gun. Pressure-test the long string. Perforate the long string.
9. Squeeze the acid in the long string into the formation and, after a minimum 3 hours waiting on acid, fracture the Cardium formation with the designed volume.

The two strings of tubing are run together using single elevators and slips on the long string. Pup joints are needed occasionally in the short string to stagger the collars. When adding a joint to the long string, it is necessary to lower the top of the short string below the table. To prevent mud getting into the pipe, a bull plug is screwed in handtight.

Nonupset tubing is used in the short string to minimize center-to-center distance between strings.

At this time, three associated completions have been made in Keystone field. The long strings flow from the Cardium sand and the short strings pump from the basal Belly River sand. When it becomes necessary to pump the long strings, there should be no difficulty since equipment is available to pump dual-string wellheads.

This method of dual-zone completion is a means of developing otherwise uneconomic reserves. Compared to a conventional dual-zone completion, $13,700 or 1.8% can be saved using this method.

How to measure tube-wall temperature to maintain high production and prolong onstream time. Proper location and installation of thermocouples will help you get temperature measurements that mean something.

BY F. S. BECKER AND F. M. KEPLER
Sun Oil Co.

ACCURATE AND RELIABLE tube-wall-temperature measurement will pay you dividends. In fact, it's almost a necessity to operate fired heaters safely and efficiently. And when used properly, these temperatures will give you useful operating guides.

Fig. 1 shows how tube temperatures can give such guides. The graphs were taken from operating data on a vertical-tube crude-oil heater during a 170-day run.

Note that after 100 days onstream the maximum tube-wall temperature had reached 1,010° F. and the average was 920° F. Also note that fouling in the heat-exchanger train ahead of the heater had dropped the oil inlet temperature from 530° to 505° F., causing the furnace to be fired more intensely to maintain throughput.

It is apparent that the maximum allowable tube temperature of 1,050° F. would be reached in about 120 days unless the furnace load was reduced. This was accomplished by quickly cleaning several heat exchangers to increase the furnace-inlet temperature. Thus the run was extended to the scheduled 170 days without damage to heater tubes and with only a small sacrifice of throughput.

Adapted from a paper presented at the twenty-fifth midyear meeting of the API's Division of Refining, 1960.

Selecting Installation Points

The number of thermocouples which are placed in a heater depends on its size, flow arrangement, type of service, and general configuration. Naturally, there is an economic limit and, therefore, thermocouples are installed only on the hottest tube.

At our Marcus Hook refinery, large multicoil heaters have as many as 20 installation points and small heaters have as few as 4 installation points.

Care should be taken to pattern these points to permit detection of hot spots. For example, if a horizontal-tube heater has an effective tube length of 40 ft., installation points should be at about 8-ft. intervals between tube sheets. It would be erroneous to place all the thermocouples at, say, 20 ft. from the tube sheets because the furnace could be much hotter at the ends than in the center. If this were the case, tubes could become overheated without detection.

Probably the most important factor to consider in selecting installation points is the fouling pattern. Those tubes which become most heavily fouled are generally the hottest in the furnace unless they are located in the convection section.

In a new heater, it is not easy to predict exactly what this pattern will be because it depends on the nature of the charge stock, as well as heater configuration, and predictions sometimes go amiss.

In crude-oil heaters, we have found that the hottest tubes are generally located near the point were vaporization begins. Fouling is generally heaviest in these tubes, particularly when charging crude oil which is not desalted.

In most other heaters, thermocouples are placed on tubes near the outlet or on tubes near burners where the heat flux is highest.

Measurement problems arise from the fact that the point of measurement is surrounded by gases and flames that are 500° to 1,500° F. hotter than the tubes themselves. Not only is the furnace atmosphere extremely detrimental to thermocouple wires, but there is also the tendency to transfer heat through the thermocouple assembly to the point of attachment. Excessive shielding for wire protection changes the temperature of the tube surface at the point of measurement.

Design and Installation

Metal-sheathed thermocouples protect wires from destruction by the heater atmosphere, and yet the assembly is not so large as to cause much temperature error because of

Installation technique . . .

The best designed thermocouple obtainable will not give satisfactory service unless properly installed. We cannot stress too strongly the extreme care that must be exercised in the installation of tube-wall thermocouples. We find that the following details must be faithfully adhered to for maximum reliability:

- The heater tube must be thoroughly cleaned by wire brushing or grinding to remove scale and dirt before welding on the thermocouple block.
- The block must be welded on all four edges and not just tacked on.
- The hole in the block must be carefully reamed and cleaned to remove scale before inserting the thermocouple.
- Care must be taken to be sure the thermocouple tip is touching the heater tube before it is peened into the block.
- The thermocouple must be tightly banded to the heater tube until it reaches the point at which it is to go through the heater wall. This affords maximum protection from excessive firebox temperatures.
- The thermocouple must be brought out of the heater at the nearest possible point.

conduction of heat from the hot gases to the tube wall through the thermocouple assembly. Furthermore, they are more flexible than No. 8 gage bare-wire thermocouples, are less susceptible to destruction from vibration, and are easier to handle.

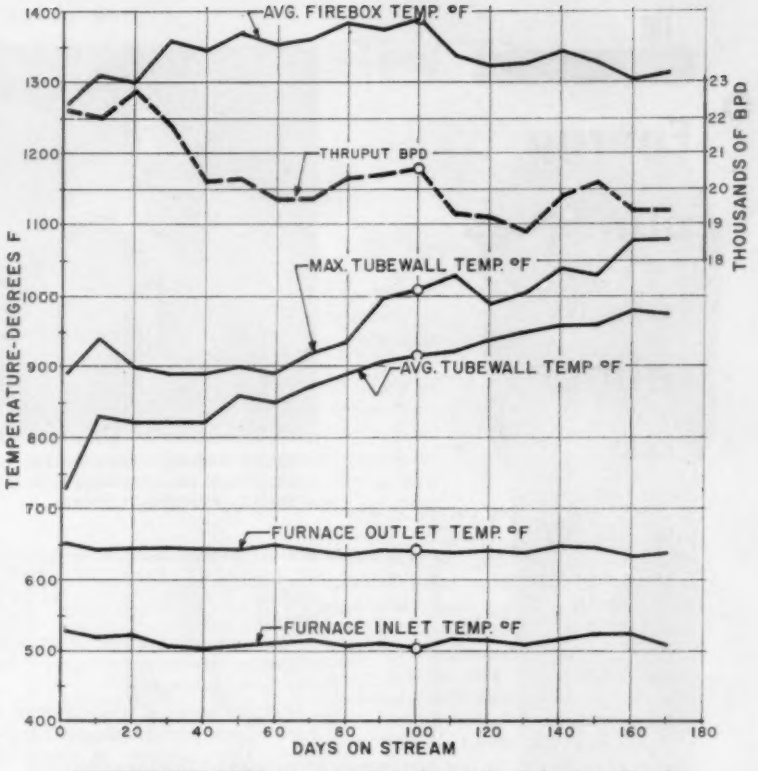
Fig. 2 shows a design for attaching this type of thermocouple to heater tubes. The attachment block is 7/16 by 7/16 by 3 in. in size and is made of the same metal as the heater tubes.

As shown in Fig. 2, two holes are drilled through the block at an angle of 30° through which the thermocouple is inserted. The two holes enable us to replace the thermocouple at least once without welding a new block on the tube. This is important with alloy tubes, as the stress relieving required after welding is both expensive and time consuming.

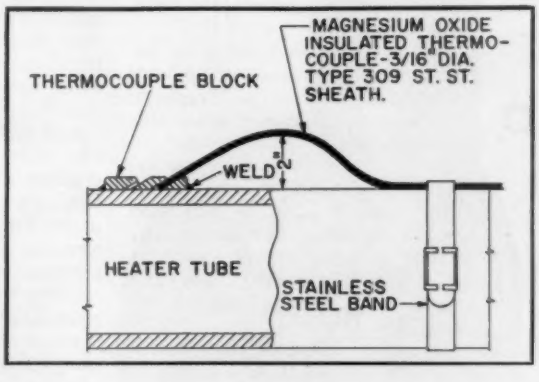
After the block has been welded on the tube, the thermocouple is inserted in the hole in the block and peened tight. The thermocouple is then held firmly to the tube with stainless-steel bands and brought out through the heater wall at the nearest point.

Chromel-Alumel thermocouples with a 3/16-in.-diameter, Type 309 stainless-steel sheath have given us excellent results. The average life is more than 1 year, with some thermocouples lasting as long as 3 years.

In an effort to cut down on installation costs, we have experimented with several devices for clamping thermocouples to the tubes instead of welding them. Thus far, results of these tests have been disappointing. The clamped-on thermocouples read as much as 200° F. higher than the welded block type.



PERFORMANCE DATA on a vertical-tube crude-oil heater. Fig. 1.



FOR GOOD RESULTS, attach metal-sheathed thermocouple to heater tube in this manner. Fig. 2.

New problems. We find wide variations in the life of these prefabricated thermocouples, leading us to believe that manufacturing quality is not uniform and could be improved. Uniform quality would be valuable even if it increased the price because installation costs are high and reliability is essential.

Many of our initial problems were caused by failure of the stainless-steel-sheath material. This difficulty has been almost eliminated by changing the outside diameter of the sheath from ⅛ in. to 3/16 in., with a corresponding increase in wall thickness, and by changing the sheath material from Type 316 to Type 309 or Type 310 stainless steel.

Most of our recent problems have been caused by failure of the Alumel wire, Photomicrographs taken of the Alumel wire from thermocouples that failed in service showed tremendous grain growth. In some cases, the grain size was as large as the diameter of the wire (No. 22 gage) so that any slight vibration would cause the wire to break at the grain boundary.

Closer metallurgical analysis, such as photomicrographs of each batch of thermocouple wire after fabrication, or a better technique, in the annealing process should produce more reliability in the finished product.

We cannot make any definite statement as to the length of time these thermocouples will retain their accuracy under operating conditions. Tests run on No. 22 gage Chromel-Alumel thermcouples at 1,600° F. for 1,000 hours in an oxidizing atmosphere indicated a maximum error of 7° F. However, there are no figures available for an inert atmosphere. We do know that thermocouples in use for 2 years were at least within 25° F. of their original accuracy.

We are not satisfied that thermocouples are the ultimate method of determining tube-wall temperatures because at best they only indicate spot readings. Possibly some method of optically scanning the entire surface of every tube could be devised by the use of thermistors with suitable filters to eliminate the effects of hot gases and refractory surrounding the tubes.

However, we do believe that until improved methods are developed, metal-sheathed, oxide-insulated thermocouples are the most reliable and accurate way to continuously measure tube-wall temperatures in fired heaters.

The FOREMAN'S PAGE

Energy principles for refinery use

REFINERIES supply energy in several usable forms. Gasoline, kerosine, heating oil, diesel oil, fuel oil, and liquefied petroleum gases (LPG) are used for one purpose—to produce energy. We are interested in energy not only because it is the main product, but also because we use energy in so many ways in running a refinery.

Refineries use about 1 unit of energy for every 10 that are sold. Energy drives the pumps and compressors, fires the furnaces, and lights the light bulbs.

The dictionary says energy is "internal or inherent power"; the physics book defines energy as "capacity for doing work." Energy could also be called "ability to do things."

There are many kinds of energy. Heat, light, electricity are all different forms of energy. In your body you are expending heat energy, expending chemical energy stored as sugars and fats in your flesh, and kinetic or mechanical energy because of your motion.

Energy is measured in different units as length is measured in inches, feet, yards, miles, etc. The most common units of energy are listed in Table 1.

TABLE 1

Kinds of energy—	Unit
Heat	B.t.u. (British thermal units)
Electricity	kw.-hr. (kilowatt hour)
Mechanical work	hp.-hr. (horsepower hour)
Kinetic (moving)	ft.-lb. (foot-pound)
Potential (height)	ft.-lb. (foot-pound)

Conservation of energy. There is a law or rule in physics that although energy can be transformed or changed from one form to another, it cannot be created or destroyed.

"HERO'S ENGINE" demonstrates how energy can be converted—chemical to heat to potential to kinetic.

We are all familiar with many examples of changing energy from one form to another.

For example, a refinery may sell fuel oil to an electric-power company. The company, in turn, burns this fuel in boilers. The stored chemical energy of the fuel is changed into heat energy by burning the fuel. This heat energy (B.t.u.) is transferred to water to produce steam which contains heat energy and stored pressure energy.

The steam is fed to a large turbine which transforms the heat and pressure energy of the steam into mechanical energy (turning of the shaft). This in turn is converted into electrical energy in the generator. Electrical energy is sold back to the refinery where it is converted into mechanical energy by motors.

In an air compressor, mechanical energy is changed into pressure energy which is stored in the compressed air. The compressed-air energy may then be used to drive an air hammer. The mechanical energy of the air hammer is used to break up concrete and in doing so is changed into heat energy. This heat energy warms up the concrete and surrounding air and eventually ends up making the world a little bit warmer.

The energy may not be available for use but it is still around in the form of heat energy.

Here is an example of what we mean by conservation of energy.

An electric refrigerator is placed inside of a well-insulated room. The **only** thing going into or out of the room is an electric cord to supply electricity to the refrigerator. The refrigerator door is open and the refrigerator is turned on. The temperature of the room will:

(a) Go up.
(b) Go down.
(c) Remain the same.

The correct answer is (a). The temperature of the room will rise because energy (electricity) is going into the room but there is no energy leaving the room. The energy content of the room increases and is converted to heat energy so the room temperature goes up.

Similarly, a running pump with the discharge valve shut will heat up and possibly ruin the seal, vaporize the liquid being pumped, and rupture the pump casing. If energy is put into a piece of equipment, it is either stored or it will find a way out.

The main purpose of most refinery equipment is to either change energy from one form to another or to transfer energy from one place to another.

Fans, blowers, pumps, motors, compressors, turbines, engines, elevators, furnaces, boilers each convert one kind of energy into another kind.

A heat exchanger, an electric cable, or a compressed air line move or transfer energy from one place to another.

In an orifice-plate meter, pressure energy in the fluid is converted into kinetic (or velocity) energy.

Since energy cannot be created or destroyed, a fixed amount of one kind of energy can be transformed into no more than a fixed amount of another kind.

For example: One kw.-hr. (1,000 watt-hr.) can be changed into 3,415 B.t.u. of heat energy—no more, no less. The same kw.-hr. can be changed into 1.341 hp.-hr. The relationships of different energy units to one another can be equated against a common 1 M.B.t.u. unit as follows:

1 M.B.t.u. = 0.293 kw.-hr.
1 M.B.t.u. = 0.393 hp.-hr.
1 M.B.t.u. = 777,500 ft.-lb.

(One ft.-lb. is the amount of energy needed to raise a 1-lb. weight 1 ft. in height.)

1 M.B.t.u. = chemical energy released by burning 1 oz. of heating oil.

1 M.B.t.u. = approximately the amount of heat energy contained in 1 lb. of steam.

1 M.B.t.u. = 196,000 lumen-hours = light energy of 128 100-watt incandescent light bulbs burning for 1 hour.

This material taken from process-training-program manual, Bayway, N. J., refinery of Esso Standard Division of Humble Oil & Refining Co.

Baker's New Snap-Set Duals

—the packers that are bringing single-zone control and simplicity to dual completions

A Baker dual-string completion approaches the control and simplicity (and the flexibility) of a single-zone completion. What makes this possible? Mainly the development of better upper retrievable packers—Baker's new Snap-Set Dual Packers. Operators all across the country are commenting on their impressive performance.

What makes a good dual-string packer? Several things, starting with the ability to (a) set and unset readily and repeatedly; (b) pack off and retrieve easily; (c) hold a dependable packoff even when pressures and temperatures are high.

Do Baker's new dual packers do these things? They do. This is easy to understand when you consider Baker's vast experience with high performance retrievable squeeze packers. The Baker Full-Bore Cementer, for instance, has seen action in thousands of successful high pressure cementing, frac, and testing operations. This squeeze packer experience has made important contributions to the design of these new dual production packers.

That's only a brief look at the story of these remarkable packers. A few more of the interesting facts are spelled out by the pictures and text below. For a complete fill-in on Baker snap-set duals and the hookups they're used in, consult Baker's field staffs and send for literature.

FACTS ON PLANNING DUAL-STRING COMPLETIONS

Baker field staffs have all the latest facts and figures on Baker's intensive continuing study of dual-string completions. They will welcome your inquiries. We will also be glad to send you the latest literature. Please write Baker Oil Tools, Inc., P.O. Box 2274, Terminal Annex, Los Angeles 54, California.

TWO BASIC MODELS. Model J (Product 756-J) is long-string set. Model K (Product 756-K) is short-string set. Both come with or without hold-down buttons (double or single grip). The pictures show single-grip Model J.

WHAT MAKES A GOOD DUAL PACKER?

The text above tells some of the things that are important. Here are a few more of the facts, starting with big unrestricted bores. Big bores are important because they permit you to run instruments and workover tools. These are probably the largest bores it's possible to design into a dual packer. For instance, a Baker dual packer for 7" casing is full-opening for two strings of 2⅜" tubing.

POSITIVE PACKOFF AND RELEASE

This three-element packing element design achieves a positive and lasting packoff with minimum set-down weight. It also simplifies release when you want to reposition or retrieve. What makes this possible is that the design prevents packing element extrusion without using the conventional metallic back-up rings that sometimes stick to the casing and defeat retrievability.

WHY SNAP-SETTING IS IMPORTANT

This simple snap-latch is what makes a Baker dual packer so easy to set and unset repeatedly. There are no one-shot shear pins. There's no ball dropping, no pressuring, no rotation. Just set down minimum weight to set packer, and pick up to release. This simplifies spacing out and enables you to test packers before displacement.

YOU CAN DISPLACE WHILE FLANGED UP

Using a side door completion valve, or sleeve valve, or other method, you can displace mud and wash in both zones with well head flanged up and under complete control.

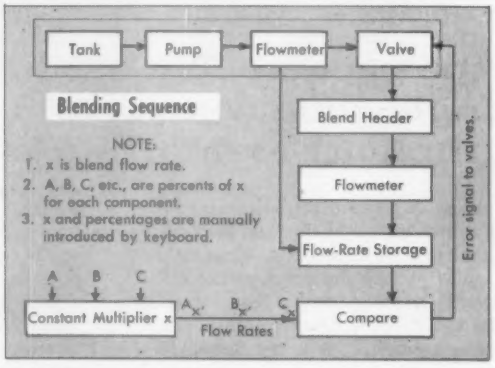
BAKER

SNAP-SET DUAL PACKERS

BAKER OIL TOOLS, INC. HOUSTON • LOS ANGELES • NEW YORK

New digital system permits continuous in-line stock blending

More efficient blending operation cuts off-specification product, minimizes storage and operating costs, simplifies mixing of the steadily increasing number of blending stocks and additives.



IN BLENDING SEQUENCE, operator dials the blend flow rate, total blend quantity, and other instructions, and the controller calculates individual flow rates. Fig. 1.

A NEWLY DEVELOPED digital system for continuous in-line blending permits as many as 60 different gasoline and middle-distillate stocks and additives to be blended rapidly and accurately.

The system (introduced by Information Systems, Inc., Los Angeles) is capable of handling base stocks and additives simultaneously and continuously to assure uniform mixing. All components are added in the correct mixture so that mixing tanks are not needed. The system is capable of meeting an accuracy of 0.5%. This means that the amount by volume of stock or additive in the final blend shall be within ± 0.5% of the amount designated.

Flowmeters feed flow-rate data to digital integrator electronic circuits. At this point, the actual flow rate and the integrated flows are compared with commanded conditions. In the event the actual flow condition does not agree with the commanded condition, the system executes an adjustment to the flow rate.

Outputs from the digital controller are d.c. voltages. These control voltages are fed through transducers to diaphragm motor valves on the individual stock and additive streams.

The memory capability of the incremental digital controller gives the blender almost unlimited flexibility. Rates, computation forms, and other parameters can easily be changed without hardware adjustments. Precautions are taken to make the equipment fail safe in the event of system failures. The system does not permit the delivery of any off-specification product into the blend manifold.

The system described is based upon predetermination of the desired composition of blends. But it is possible to expand the digital-controller capacity to permit it also to determine the optimum composition of each blend. This would take into account variations in octane numbers, vapor pressures, and other base-stock properties, as well as relative refinery costs of the various base stocks and additives.

Flowmeters

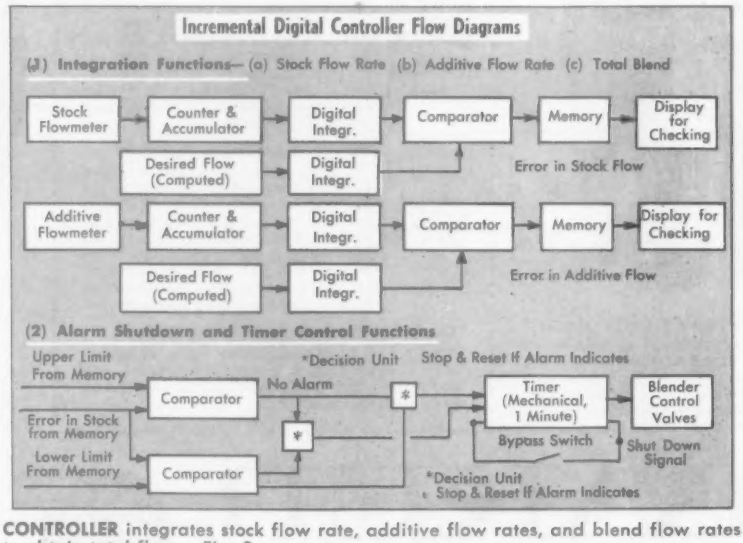
Turbine flowmeters or their equivalent are needed as sensing devices in the system. These meters emit digital pulses in which a specific pulse is a measure of an incremental volume of fluid that has passed through the meter. If the pulses are accumulated in a counter, the result is an integrated volumetric flow. The turbine flowmeter gives more accuracy, faster response, and greater versatility than conventional flowmeters when appropriately applied.

The flowmeter electronic sensing element uses the hydraulic pressure of the measured fluid itself to suspend the turbine-type rotor in an axial floating position. Thrust friction is eliminated, and the rotor spins freely without slippage at a rate governed by, and directly proportional to, the velocity of the flow through the unit.

Mounted within the body of the low-frequency rotor is a small, permanent magnet, polarized at right angles to the axis of rotation. As the rotor spins, this magnet sets up an alternating current in a coil of wire held within its field in an external mounting.

Pulse amplifiers, as necessary, are provided at the meters to transmit the information from these sensors to remotely located control equipment.

The integrated flow is presented as six decimal digits on self-decoding



CONTROLLER integrates stock flow rate, additive flow rates, and blend flow rates to obtain total flows. Fig. 2.

digital readouts. Readout is directly in barrels. Flow rate is also displayed. For base stocks the display consists of four-decimal characters calibrated in barrels per hour. For additives, the panel displays are three decimal digits calibrated in gallons per minute.

Digital Controller

The digital controller is the decision-making center of the blender-control system. It consists basically of a highly efficient disk memory which is used for storage, integration, and computation. In addition, there are appropriate tie-in electronic subsystems to communicate with the digital controller from the remainder of the system.

The blending-sequence operation is depicted in Fig. 1. After the operator has dialed in the blend flow rate, total blend quantity, and other such instructions, the controller calculates individual flow rates and stores them.

Actual flow-rate measurements are continuously compared with the desired flow rates and an error signal is delivered to the appropriate control valve when indicated. In addition, the controller integrates stock flow rate, additive flow rates, and blend flow rates to arrive at totalized flows.

These totalized flows are compared by the controller with stored values. This results in a difference value which is again related to upper and lower stored limits. If an out-of-tolerance condition is detected, the controller initiates an alarm and, if desired, a programed shutdown sequence.

A running check is made of the blend rate with the prestored blend-rate constant. If the digital controller determines a discrepancy, corrective signals are fed to all stock and additive control valves.

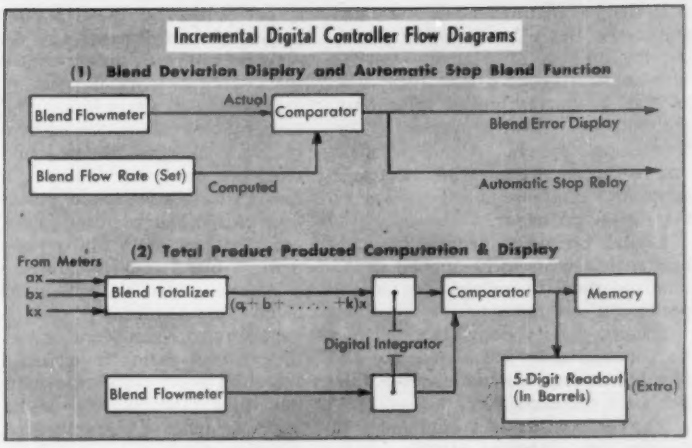
Periodically, the inputs from all stock and additive flowmeters are summed and integrated. This figure is compared with the integrated blend flows. Any difference is stored and displayed.

An important function of the digital controller is the stop-blend computation. This is executed by subtracting the preset total blend from the integrated total blend. When this difference reaches zero, the digital controller releases a signal which triggers the shutdown procedure.

Digital-controller flow diagrams are shown in Figs. 2 and 3 and indicate the data flow and decision-type activities assigned.

Controller Console and Displays

The digital blender system consists of four basic functional building blocks, each independent in expansion capability. They provide the flexibility to a system to be specifically designed for a given set of requirements without major modifications to subsystems; at the same time they permit expansion at a much later date without obsoleting the components. The four blocks are the flowmeter assembly and control unit, incremental-digital console, central-control panel with displays, and the localized remote-control panel.



STOP-BLEND COMPUTATION subtracts preset total blend from integrated total blend. When difference is zero, a signal triggers shutdown procedure. Fig. 3.

Flowmeter assembly and control unit. This unit contains the terminal blocks and switching circuitry for all turbine-flowmeter units and allows addition, switching, and checkout examination of the basic sensing devices in the system.

Incremental-digital console. The ID (incremental digital) console is a transistorized solid-state incremental-digital controller combining the accuracy, reliability, and sophistication of the digital computer with the ease of programing and operation of the analog computer. Operation can be performed by personnel of average skill with a minimum of training. Maintenance can be performed by process-instrument personnel because it is based on pure substitution of unit components; thus there is no need for highly trained electronics specialists.

The ID console is a unique digital controller in two respects: It is environmentally equipped for refinery operation designed for pressurization by normal instrument-air supplies; it may be placed near moving equipment which can subject it to vibration.

The ID controller performs the following functions:

1. Accepts turbine flowmeter outputs of up to 60 meters, converts them to digital form and stores them on a magnetic-disk memory;

2. Samples the 60 inputs within an interval and compares these values with preset upper and lower safe operating limits of these variables, generating an alarm whenever a limit is exceeded and a visual indication of the particular variable that is off limits;

3. Provides sixty 19-bit plus-sign integrators which are individually scalable and also 60 constant multipliers, each of which can be used to multiply the output of an integrator by a constant to produce an output in appropriate units;

4. Initial values of all integrands are also stored and a restart feature is provided which allows the operator to reinitiate a computation simply by setting a single switch;

5. All variables can be displayed in a digital readout form to indicate the present status of any blend or deviations from set-in requirements to the operator;

6. The output system will also convert any of the computed quantities (selectable by means of a plugboard) to d.c. voltage signals suitable for driving the set points of valve actuator controllers;

7. The machine is filled initially by either the reading of a punched paper tape when the entire contents of the memory can be filled in 4 minutes or manually by operator keyboard. A paper-tape punch and verifier is also optionally provided to prepare the initial tape and verify its correctness;

8. A monitoring system is provided which allows the operator to inspect the contents of any integrand, sampled value, or constant register upon demand; to start, stop, and reinitiate a computation; to make minor insertions and corrections to data in the memory.

In the automatic blender, integrated volumetric flows are formed by adding the outputs of a flow. After a suitable adjustment of the form $y = ax + b$, to convert pulses to volume, the totalized flow is presented on readout-out panels. Actual totalization is accomplished with electronic integrators that are a subdivision of the digital processor.

Digital processor programing permits scale factors to be applied to the totalized flows to multiply by various predetermined factors.

Specific-gravity compensations can be automatically calculated on the blender before presentation as a flow rate or a totalized flow.

The system includes equipment to handle the addition of the stock-stream running totals. This addition is performed by the ID controller.

Central control panel with displays. A single, compact, master-control console, which includes all input, control, indicating, and alarm functions, panels and equipment, is included in the system. All inputs and control equipment are easily accessible. All indicators and readouts are prominently displayed. The required number of separate stock and additive panels and master blend panels are supplied.

Also mounted on the console are blend-header pressure indicators, vapor-pressure-recorders, and selective remote tank-gaging indicators.

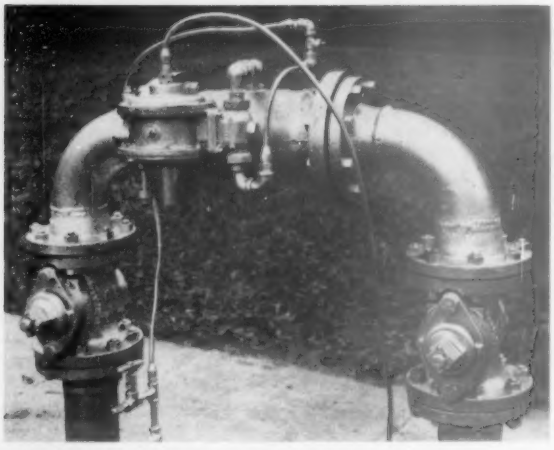
Pumps select switches, remote manual valve controls, and meter-range select switches are supplied on each panel as required.

Full manual overpowering control is available at supervisor's option when desired.

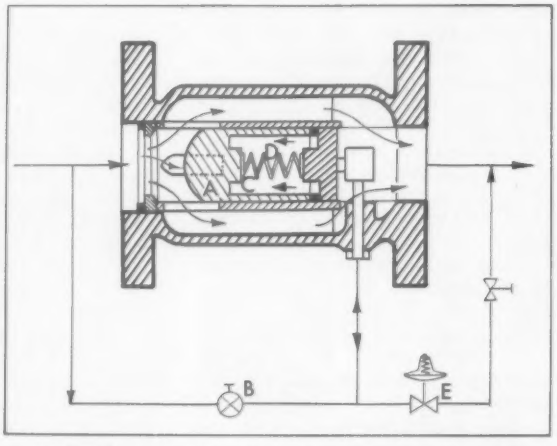
Localized remote-control panel. This unit is a small-scale model of the centralized-control unit occupying a rack-size cabinet for installation in remote areas for display and local-control functions if desired. The design embodies one control panel per two stocks or additives.

In addition, where desired, the final control elements, consisting of control valves and associated electro-pneumatic transducers, can be included in the system. The maximum tolerance in the composition of the final blend is also specified.

The system in the control room provides a continuous d.c. voltage or current-control signal for valve operation.



SLIDE VALVE can be used almost anywhere a gas valve is needed by adding the proper type pilot system. Fig. 1.



CYLINDRICAL IN SHAPE, the slide valve is different from most relief valves and gas regulators in appearance. Fig. 2.

New slide valve is compact, versatile

THE SEARCH for a single valve that can be used anywhere a gas valve is needed resulted in the development of a new slide valve. This valve, invented by Howard Clark, of Arkansas Louisiana Gas Co., unlike most relief valves and gas regulators, is cylindrical in shape. It is compact, and may be installed in horizontal or vertical position, above or belowground.

According to Reynolds Gas Regulator Co., a subsidiary of ALG and producer of the new valve, the only restricting limit to slide-valve operation is lack of pressure. A minimum pressure of 5 psi. at inlet or 5 psi. minimum differential between inlet and outlet is required. The valve's upper pressure limit is the pressure rating of the metals it's made from.

With the proper type of pilot system, the slide valve can operate as a regulator, motor valve, back-pressure regulator, relief valve, shutoff valve, remote-controlled plug valve, monitor regulator, differential controller, or process controller. It can be manually operated, pilot operated, or instrument operated with pneumatic or hydraulic systems.

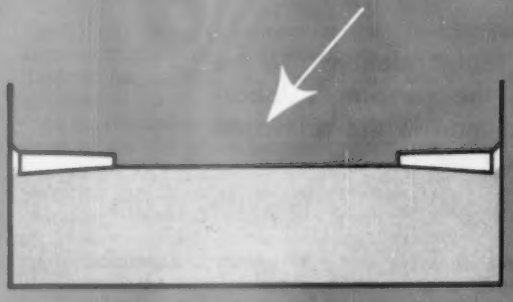
The fundamental principle of operation is as follows: Inlet pressure exerts force on the plunger (A) to open the valve and is also piped to the cylinder through a needle valve (B) where it exerts the same force on the same area inside the cylinder head (C) to close the valve. With the opening and closing force equal, the mainspring (D) in the cylinder head keeps the slide closed. Pressure from the cylinder head is piped through a pilot regulator (E) to the outlet piping.

The pilot regulator is adjusted for the desired outlet pressure, the pilot will open and allow more gas to flow through its orifice, thereby causing a decrease in pressure in the cylinder head as the needle valve restricts the amount of gas the pilot can pass. The inlet pressure forces the slide valve open till its force is in balance with pressure in the cylinder head plus the spring tension, allowing gas to flow through the four cylinder ports.

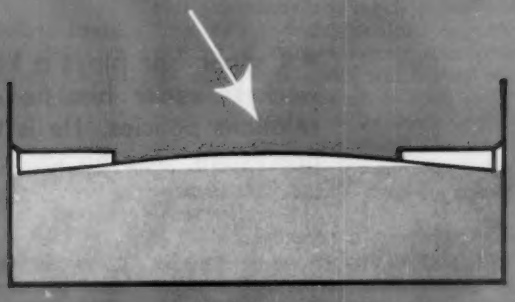
When the new flow rate has been met, the pilot opens or closes as the outlet pressure tends to increase or decrease and by so doing, allows the pressure in the cylinder head to increase or decrease to give the desired counterbalancing results. The pilot also regulates its flow to compensate for any additional power required due to change of inlet pressure or friction during travel.

Efficient VAPOR TRAPPING...

a "built-in" feature of HORTON® FLOATING ROOFS for over 35 years



The Horton Pontoon Floating Roof has an annular pontoon around the outer edge of the roof and a deck of single thickness at the center. The pontoon provides effective air space insulation for a large area of the liquid surface. Under normal conditions, the underside of the Horton Pontoon Floating Roof is in contact with the product in the tank.



Increased temperatures may cause the product in the tank to boil. Should this occur, the vapors are trapped beneath the center section of the roof due to the upward slope of the pontoon bottom and the flexibility of the center deck. The trapped vapors lift the center of the deck and provide an insulating vapor space to reduce further boiling.

130,000-bbl. tank equipped with a Horton Pontoon Floating Roof serves the marine loading terminal of a West Coast oil company.

Prime reason for equipping flat-bottom storage tanks with floating roofs is to prevent the loss of valuable volatiles through evaporation. Efficient vapor trapping is essential for the more volatile stocks.

The sun's rays striking the single deck portion of a floating roof heats the deck and the product beneath. Boiling often occurs, causing vaporization. Unless these vapors are retained by the deck rising from the product, boiling will continue. Horton Pontoon Floating Roofs trap these vapors. They form an insulating space during the heat of the day retarding further boiling. As cooler temperatures occur, the vapors recondense and the deck returns to the liquid surface. The result: *Maximum protection against costly evaporation loss and deterioration of product.*

Vapor trapping is just one of the many money-saving features that have made Horton Floating Roofs your best buy for over 35 years. Write today for the complete story.

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OFFICES AND SUBSIDIARIES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

P93CB

How Sohio trains supervisors in labor relations

●A supervisor plays a key role in labor relations. To the workers under him he represents the company's labor-relations policies. He is the contact man in the grievance procedure. Tap his ideas. It will pay off.

BY JAMES J. BAMBRICK
Assistant Manager of Labor Relations
Standard Oil Co. of Ohio

THE SUPERVISOR can be extremely helpful when preparing for negotiations, but to effectively do his labor-relations job he needs training. One of the ways to provide this training is through a course designed to give him the background information he needs to make better labor-relations decisions.

At Standard Oil Co. of Ohio such a course is given to the refinery, marketing, transportation, engineering, administrative, accounting, and finance groups. The course varies from group to group to reflect their differing labor-relations interests.

Refinery Course

The basic course given at the refineries consists of five 2-hour sessions. Each session consists of a lecture followed by a discussion.

The course is given to all line management from foreman to refinery manager, including engineers and technicians. This latter group is included because:

1. Many of the engineers and technicians might be transferred or promoted to line supervisory positions and it is best that they go into such jobs with an understanding of labor relations.

2. They consider themselves part of the management team and including them strengthens that feeling.

3. It is a good idea to keep them informed before a crisis is reached. You cannot tell any group, "You are part of management when things get hot, but otherwise you are not."

Adapted from an address presented to WPRA, Wichita, Kans., June 15, 1960.

At the beginning of each session, each participant is furnished a detailed outline plus supplementary reading material and a bibliography. The outlines are in great detail. This is deliberate. It saves taking detailed notes.

As is true with most adult groups, line supervisors are not used to taking notes. With a detailed outline they can follow what is said with a minimum of note taking. Moreover, they can use the outlines to reconstruct the whole talk at some later date.

Here's what's covered in the five sessions.

1. History of unions.

The first session gives the background of the labor movement in the United States. The story is told in terms of the seven principal labor leaders: Samuel Gompers, John L. Lewis, William Green, Philip Murray, George Meany, Walter Reuther, and James R. Hoffa.

This session gets the supervisors keenly interested. It is given because it is absolutely essential that supervisors get an idea of how we got where we are in labor relations, so that they understand some of our country's labor-relations problems.

2. Legal background.

The second session covers the legal background of collective bargaining. It shows that for most of American labor history there were no laws on labor relations. Rather labor law was based on court decisions based on common law. English and American common law held unions to be conspiracies in restraint of trade. The courts over a period of a hundred years gradually changed that doctrine so that it was less onerous to unions.

The supervisors go over sections of the Wagner Act, Taft-Hartley Act, and the newly passed Labor-Management Reporting and Disclosure Act of 1959 that especially apply to them.

One of the purposes of this session is to give the supervisor and management executive basic facts as to what he can and cannot say in labor-relations situations. The whole presentation is in nontechnical language.

Its purpose is not to make lawyers, but to make executives and supervisors realize on what matters they should call the company's counsel before they make a move.

3. Labor in the oil industry.

The third session comes very close to home. It deals with labor relations in the oil industry; events in which they have participated. It gives them background information on events that led up to and caused the things that they have experienced.

We found that there was no single source that gave in full the picture on labor relations in the oil industry. Rather, it took a great deal of research, and a great deal of personal contact, to pull together the full story.

Oil-industry labor relations are basically a conflict between independent unionism and outside trade unionism. A review of the past indicates that

"To a considerable extent supervisors can nullify the contract . . . by failing to enforce its provisions. They can ignore employe actions in violation of the contract, and overlook situations they should bring to the attention of management. They can fail to mete out disciplinary penalties specified by the contract."

usually one gains ascendency at the expense of the other. The broad outlines of the conflict are covered in this session.

In the discussion period that follows some of the old timers invariably fill the group in on the events of yesteryear that greatly influence the events of today. Discussion quickly gets down to the how and why of the company's labor relations, and the events that may affect the supervisors as members of the management team.

4. Labor-relations policies.

Unions have their policies and long-range goals set forth in writing. Is the same true of management? The fourth session is aimed at answering this question.

In this session the supervisor sees the key role he plays in the achievement of the organization's over-all objectives. An organization's success or failure can be measured by the extent to which its practices carry out its policies or goals.

In this endeavor each level of management plays its part. The executive officers and board of directors must set up worth-while and realistic policies. Managers must put these policies into workable procedures. And the supervisors must oversee these procedures so that the practices within the organization carry out the over-all goals. No part of the management team can do without the other. They are all working for a common goal—the organization's goal.

The session then quickly focuses on labor-relations policy which is defined as "the expression of a company's or a union's basic belief concerning matters dealt with in collective bargaining." It shows the advantages of having labor-relations policies. Among the matters dealt with are:

- Union demands for industry-wide or company-wide bargaining versus the company's wish to bargain on the basis of the unit specified by the National Labor Relations Board.
- Union demands for closed or union shops versus company policies opposing compulsory union membership.
- Wage policies.
- Management prerogative policies.
- Policies on promotion based on merit.
- Policies opposing featherbedding and make-work rules.
- Policies on management's right to choose supervisors.

5. Supervisor's role.

Running like a thread through this session is the fact that, to a considerable extent, supervisors can nullify the contract. The most common way they can do so is by failing to enforce the contract's provisions. They can ignore employe actions in violation of the contract.

They can overlook situations that they should bring to the attention of management. They can fail to mete out disciplinary penalties specified by the contract. In each instance they are, in effect, writing new clauses or modifying existing ones.

"The supervisor's interest can be maintained by keeping him up to date on labor-relations happenings in his company and industry. This can be done through written communications, meetings, and personal contact. . . . The prime requisite is that the concept that 'the supervisor is management' become a way of life within the organization."

As examples, supervisors are given cases in which arbitrators have upheld unions when management has attempted to enforce a contract clause that supervisors have negated or ignored.

These examples also point up the fact that company rules and regulations that are not enforced are "written out" of the contract. This happens whether or not the failure in enforcement is intentional. The supervisors see that their failure to enforce rights which the contract gives them generally means that they lose these rights.

In this session the supervisor sees that grievance handling is actually a form of day-to-day contract negotiation. The contract merely sets forth the framework under which they operate. This framework is filled in by their daily decisions in resolving formal and, more importantly, informal grievances. Their decisions form the basis of their plant's common law of labor relations.

With training and experience, the supervisor soon realizes that in labor-relations matters he can't simply be a "Good Joe." His criterion for sound decisions then becomes: How would this affect us if it became general practice? For with a union in the picture, the exception can—and frequently does—become the rule.

At a number of locations this fifth subject continues for several more weeks as the supervisors take up their contract section by section and consider the local problems which have come up under the contract.

Experience shows that, once the supervisors get to considering practical labor-relations problems that directly affect them as supervisors, they never want to stop. That is as it should be. Labor relations then become for them a way of life.

How to Maintain Interest

The supervisor's interest can be maintained by keeping him up to date on labor-relations happenings in his company and industry. This can be done through written communications, meetings, and personal contact.

He can participate in the labor-relations process: in the grievance procedure, in arbitration, in preparing for negotiations, and, where feasible, in negotiations.

The prime requisite is that the concept that "the supervisor is management" become a way of life within the organization. He will be brought in, not after events happen as the suddenly remembered forgotten man, but before they happen. With "the supervisor is management" philosophy, he will make them happen.

BY W. L. NELSON
Technical Editor and
Petroleum Consultant

Questions on
TECHNOLOGY

Does it pay to desulfurize middle distillate?

In your Answer of August 1, 1955, about the cost of processing high-sulfur crude oils, you do not seem to include the cost of desulfurization. Isn't this a major cost, especially with kerosine or diesel fuels? G.F.P.N.

Desulfurization has not usually been included as a penalty against high-sulfur crude oil (in the costs used on this page) because the high prices received for the desulfurized products just about offset the cost of operating the desulfurization equipment. There are also other less tangible advantages in hydrodesulfurization, such as the removal of trace metals, longer life for many catalysts, and the greater susceptibility of gasolines to tetraethyl lead.

However, all that will be considered in Table 1, herein, is the cost relationships between operating costs and increased value of the products. The final crude-oil values at the end of the tabulation indicate that desulfurization is not ordinarily profitable, that losses up to 9 cents per barrel (for November 1959) are encountered by the practice of desulfurization. However, the advantages suggested above may counterbalance the extra costs.

Finally, there is the matter of quality. If high-sulfur products cannot be sold at the posted market price, then desulfurization must be practiced regardless of cost. In the next few years, lower sulfur specifications may make it necessary to charge desulfurization costs against high-sulfur oils.

Table 1 shows yields when conventional processing is conducted, and yields when desulfurization is used to permit the sale of kerosine (or for Mara crude, the sale of diesel fuel). Crude oils from West Texas, the Middle East, and Tia Juana, Venezuela, contain excellent diesel fuels but when the kerosine fraction is desulfurized more middle distillate must be cracked.

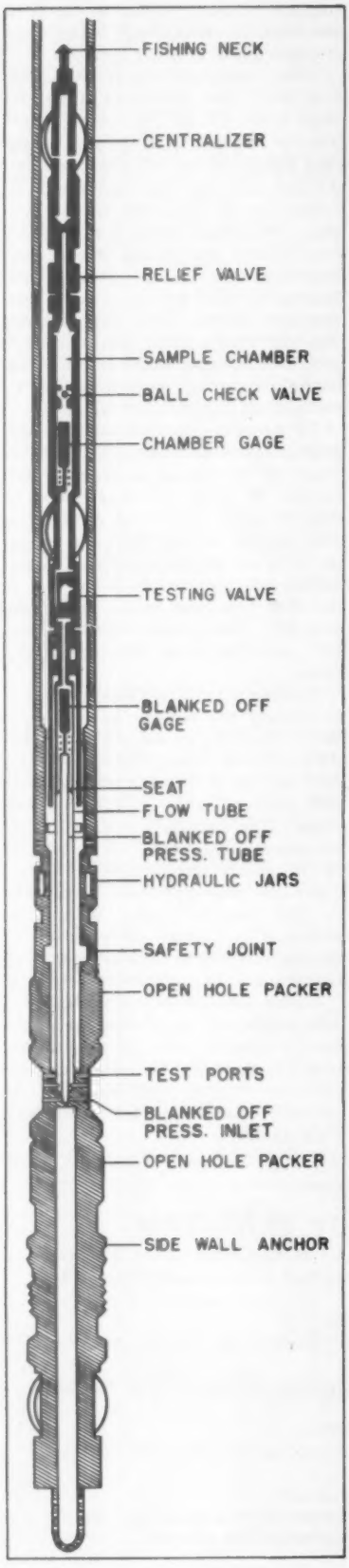
Substantially all of the middle distillate material in Kuwait and Pedernales (Venezuela) crude oil would normally be cracked, but by desulfurization satisfactory kerosines can be produced. Mara, Venezuela, crude oil contains good diesel fuel, but the kerosine fraction contains so much sulfur that it must be desulfurized.

The Standard 1956 Operating Costs of Table 1 were devised as a method of judging the quality of crude oils. The figures shown are for operation at the Gulf Coast during 1956 but the totals are for the year 1959 (Nelson Refining Operating Cost Index equals 107.0 approximate) and the somewhat larger operating cost for the East Coast is also shown.

TABLE 1—APPROXIMATE COST OF DESULFURIZING FOR THE PRODUCTION OF KEROSINE AND DIESEL FUEL (1959)

	Average West Texas		Kuwait		Average Middle East		Pedernales, Vene.		Tia Juana (Med.) Vene.		Mara Vene.	
Crude Properties	Conv.	Desulf.	Conv.	Desulf.	Conv.	Desulf.	Conv.	Desulf.	Conv.	Desulf	Conv.	Desulf.
API	35.0		31.6		36.0		21.0		26.3		29.5	
% sulfur	0.65		2.52		1.42		2.72		1.55		2.0	
% cracked	18.3	35.7	28.4		16.6	32.3	24.2		15.0	28.2	33.5	21.3
% desulfurized		17.6		15.5		20.0		13.0		14.4		26.1
Yields, %												
SR gasoline	30.5	28.0	27.7	25.4	30.4	27.6	16.7	15.0	21.5	19.6	22.0	22.0
Cr gasoline	10.2	21.8	17.0	17.0	9.3	19.4	14.5	14.5	8.4	16.4	20.7	12.1
Total gasoline	40.7	49.8	44.7	42.4	39.7	47.0	31.2	29.5	29.9	36.5	42.7	34.1
Loss	3.0	4.2	3.5	3.5	2.2	3.2	2.0	2.0	1.5	2.4	3.0	2.1
Kerosine		12.5		11.4		14.0		8.7		9.7		
Diesel fuel	30.5				32.4				25.0			26.1
No. 2 distillate		5.1	13.2	4.1		6.0	11.3	4.3		4.7	14.5	
No. 3 distillate	3.2	6.2	5.0	5.0	2.9	5.7	4.2	4.2	2.6	4.9	5.9	3.7
Bunker C	22.6	22.2	33.6	33.6	22.8	24.1	51.3	51.3	41.0	41.8	33.9	34.0
Product value—Nov. 1959												
Gulf	3.51	3.61	3.42	3.37	3.53	3.59	3.05	3.01	3.17	3.22	3.42	3.30
New York	3.98	4.05	3.85	3.78	4.00	4.00	3.46	3.42	3.62	3.65	3.85	3.74
Operating costs (Ct./bbl.) for 1956												
Basic investment	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7
General labor	27.6	27.6	23.7	23.7	27.6	27.6	17.4	17.4	21.0	21.0	23.6	23.6
Sulfur costs	6.5	6.5	15.0	15.0	9.2	9.2	16.1	16.1	9.6	9.6	12.2	12.2
Sourness costs	5.1	5.1	3.0	3.0	2.4	2.4						
Desulfurization‡		2.2		1.9		2.4		1.6		1.7		3.1
Basic fuel and power	4.1	4.1	3.5	3.5	4.1	4.1	2.6	2.6	3.2	3.2	3.5	3.5
Cracking, etc.	9.5	18.6	14.8	14.8	8.6	16.8	12.6	12.6	7.8	14.7	17.4	11.1
TEL for SR	8.5	7.8	18.8	17.2	21.8	19.8	3.8	3.4	3.9	3.6	11.4	11.4
TEL for Cr.												
Reforming	11.2	11.2	11.1	11.1	12.1	12.1	6.7	6.7	8.6	8.6	8.8	8.8
Overhead	7.4	7.4	7.0	7.0	7.4	7.4	6.3	6.3	6.7	6.7	6.9	6.9
Total—1959*												
Gulf	99.0	109.0	116.0	116.0	112.0	121.0	83.0	84.0	78.0	86.0	102.0	99.0
N.Y.†	104.0	114.0	119.0	120.0	117.0	126.0	86.0	87.0	81.0	90.0	106.0	103.0
Relative Value of Crude Oil ($/bbl.)												
for Gulf	2.52	2.52	2.26	2.21	2.41	2.38	2.22	2.17	2.39	2.36	2.40	2.31
for New York	2.94	2.91	2.66	2.58	2.83	2.74	2.60	2.55	2.81	2.75	2.79	2.71

*1956 costs raised by Nelson Refinery Operating Cost Index (107 for 1959).
†Overhead is slightly larger for East Coast, and fuel cost because natural gas is not available as fuel.
‡At 12 cents per barrel.



One-trip sampler is real time saver

Gets fluid and pressure from several zones for a small cost in rig time

BY PAT CHISHOLM
Halliburton Oilwell Cementing Co.
Duncan, Okla.

A SINGLE NEW TOOL now combines the advantages of the regular packer-type drill-stem test as well as the wireline tester.

This new tool is a multiple-zone sampler, part of which is run on drill pipe and the rest of which runs on a wire line. With this combination, formation samples and closed-in pressures now can be taken economically from several formations with only one trip into the hole with pipe. The samples taken from each zone are larger (up to 25 gal. and more) than with other samplers. Result is good information for a small cost in rig time.

Thus far, these appear to be the most promising uses of the new tool:

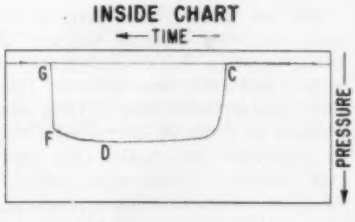
1. To evaluate exploratory wells.
2. Make reservoir studies in thick producing formations.
3. Locate oil-water contacts.
4. Make hydrodynamic studies.

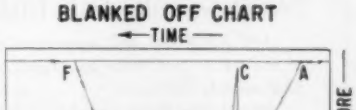
The tool is made up of two assemblies: The packer group which is run on drill pipe, and the sampler which is run on wire line. The sampler carries two pressure recorders: an inside chamber recorder; and an outside blanked-off recorder.

Interval tested may be varied from 1 to 12 ft. Briefly, there are two packers with a spacer between; these are run on pipe to the test point and set. A sampler is then run inside the pipe and landed on a seat connected to the perforated spacer. By pulling and rerunning the sampler, sizable samples may be taken and the pressure from several zones recorded. The pipe need not be pulled since it is necessary only to change packer location between runs.

MULTIZONE SAMPLER (left) comes in two units. One, that in black, is run on wire line; that shaded is run on drill pipe. After one zone is tested, packers on the drill pipe are moved and reset in new zone; wire-line sampler is pulled and rerun. Fig. 1.

TWO CHARTS (below) show whether the test is valid. Chart exposed to inside of sampler chamber doesn't register until sampler is opened at bottom of hole; it shows sampler pressure until released at surface. Outside chart shows pressure changes in running and pulling sampler. Fig. 2.





A-B RUNNING SAMPLER IN HOLE
B INITIAL HYDROSTATIC MUD PRESS.
C TESTER VALVE OPENED
C-D FORMATION BUILDUP
D TESTER VALVE CLOSED
E FINAL HYDROSTATIC PRESSURE
E-F RETRIEVING SAMPLER
F-G RELEASING PRESS. AT SURFACE

Tools run on drill pipe. The tools run on drill pipe are conventional open-hole testing tools. Starting from the bottom, there are a sidewall anchor, straddle packers, safety joint, hydraulic jar, and stabbing joint. Two concentric tubes are made up inside a perforated joint between the packers. On the upper end is a seal seat which receives the sampler. The outside tube

Paper presented under title, "Multiple-Zone Sampler" at 1960 spring meeting of API Division of Production's Southern District, San Antonio.

is connected to the perforated joint and provides a flow passage during the test.

The smaller tube is connected to a separate set of perforations so that there is no communication between it and the flow tube. When the sampler is seated, this tube seals into the blanked-off gage case.

The packer arrangement has four ½-in. fluid-bypass ports between the packers and four ¾-in. ports above the top packer. These ports help provide fluid communication inside and outside the drill pipe and above and below the packers at all times. This reduces the possibility of the well getting out of control. It also permits circulation when necessary.

Sampler assembly. Maximum diameter of the sampler assembly is 2.38 in. It is equipped with a pressure-relief valve, sample chamber, tester valve, and two pressure recorders. Centralizers at the top and on the lower portion of the sampler guide its passage through drill pipe and reduce lateral shock.

The relief valve allows the chamber pressure to be bled off manually at the surface. It is a pressure-balanced, O-ring-sealed, sliding valve.

Chamber volume is determined by the number of sample barrels run. Each barrel is 7 ft. long and has 0.9-gal. capacity.

The testing valve is an O-ring-sealed sliding type with a built-in bypass. It opens when the sampler seats. A protective shield is used to help prevent premature opening, such as might result from striking a shoulder or obstruction in the drill pipe. The valve is pressure-balanced, except when in the open position. In this position, hydrostatic mud pressure exerted over a differential area in the valve tends to hold the sampler sealed on the seal seat until after the test valve has closed and the bypass port has opened.

The sampler contains two 1¼-in. o.d. bourdon-tube pressure recorders, one in the sample chamber and one outside. The inside recorder shows chamber pressure only. The other, a blanked-off recorder, is below the testing valve (see Fig. 2). It records hydrostatic mud pressure as the sampler is lowered inside the drill pipe (A-B), pressure changes in the test interval during the sampling period independent of fluid flow (C-D), final hydrostatic pressure of the mud column (E), and returning out of the hole (E-F).

The blanked-off pressure recorder helps determine validity of a test.

The interval between packers is variable and may be as little as 1 ft. The interval to be used on a particular job depends on sand thicknesses and nature of information desired. In a case where fluid samples are important, the smaller the test interval in relation to sampler capacity, the more representative the sample. Where pressures are more important, sample volumes may be adjusted to yield a maximum amount of pressure data regardless of interval.

Surface equipment. Surface equipment required for this type operation is: (1) wireline unit; (2) lubricator and oil saver or line wiper; (3) surface gage to check chamber pressure before venting; and (4) surface control valve.

Development. Most components in this arrangement are standard equipment presently used in the field. Only minor adaptations were necessary for these. These remained to design a suitable sampler and seating arrangement.

First field test of lab-tested designs was made in the Four Corners area. A series of eight runs was made, varying from about 5,300 to 5,500 ft. A 1-ft. test interval between packers was used and the drill pipe was repositioned five times for different zones. The tool functioned properly. However, the pressure recorders and clocks suffered severe damage.

A change was made in sampler centralizers and method of mounting pressure recorders to correct this weakness. Laboratory and field tests have since proved that the new centralizers and shock-absorber recorder mountings amply protect the pressure recorders.

On the second field test, in the same area, the sampler was run 24 times between 5,300 and 5,500 ft. with 5 and 10-ft. test intervals. Pressure recorder and clock failures were reduced to 2 out of 48 recorder runs (2 recorders per run). One clock stopped before it started in the hole, and once the clock clutch became disengaged going into the hole.

Other weaknesses did develop, however, which had not shown up on previous tests. Of the 24 runs, 11 were misruns because of improper seating and failure to open the tester valve. At that time, the seal rubber was attached to the seal seat in the drill pipe. Wear and damage by oil-base mud on the seal rubber caused four additional misruns. Nine runs were satisfactory and produced very good pressure charts. Since the operator was interested only in obtaining static pressures, sample volumes were reduced to provide maximum use of test periods for pressure buildup.

To provide more positive seating, a solid spider centralizer was used in place of the spring centralizer used before. A guide sub was added to restrict lateral movement of the seat and sampler to aid in proper alignment for seating the sampler. The seal rubber was removed from the seat in the drill pipe and placed inside the sampler. This permits visual inspection and replacement between sampler runs.

Another trouble was fluid resistance to running the sampler in drill pipe. With a viscosity of about 125 seconds with a Marsh funnel, the sampler ran very slowly in 4½-in. internal-upset drill pipe with 4½-in. full-hole tool joints. The sampler's outside diameter was reduced from 2.66 in. to 2.38 in. to relieve this situation. Clearances and pressure-release ports within the sampler valve were also increased for better performance in viscous fluids. Lab tests indicate these changes will be satisfactory.

Under consideration are these developments: (1) converting to a hydraulic sampler valve to permit dual closed-in pressures; (2) adding a small chamber to trap reservoir fluid at reservoir conditions for laboratory PVT analysis.

Next week: The Industry at Midyear

THE JOURNAL will take stock of what his happened the first 6 months of the year, and what to expect the last half in the annual Midyear Report of July 25.

Watch for these important features:

- The drilling picture, showing well statistics the first half and what to look for the last 6 months.
- What's happening to demand, plus a forecast through the first quarter of 1961.
- A study of refinery runs by districts.
- An up-to-date report on who's building petrochemical, refining, and field-processing plants.
- What's ahead in pipeline construction.
- A new study on cost and price factors in the natural-gas industry.
- Some topnotch thinking on conservation and proration.

25. How to make use of capillary-pressure data

BY E. T. GUERRERO

AND

F. M. STEWART

GIVEN: A reservoir divided into five segments. Using the top and base of the net-sand maps, the areas shown in Columns 2 and 3 of Table 1 were planimetered. The free-water level was determined to be at a subsea depth of 5,130 ft. The net-to-gross ratio of sand volumes for segment 1 was determined to be 0.7 and the net sand volumes and average water saturations for the other segments were found to be as follows:

Segment	Net sand volume, ac.-ft.	Avg. Interstitial water saturation % pore vol.
2	3,050	33.0
3	950	35.0
4	1,580	34.5
5	4,100	30.5

FIND:

1. Gross sand volume distribution for segment 1.
2. Average water saturation for segment 1 assuming that the data given and average capillary pressure curve (Fig. 4) developed in No. 24 of this series (OGJ, July 4, 1960) apply to this segment.
3. Average interstitial water saturation for the reservoir.

METHOD OF SOLUTION: These equations will be used in the solution of the problems:

$$A_x = A_{Ti} - A_{Bi} \quad (1)$$

$$A_{xavg} = \frac{A_{x1} + A_{x2}}{2} \quad (2)$$

$$\Delta V_{Gi} = A_{xavg} \times h' \quad (3)$$

$$h = H + H' \quad (4)$$

$$V_G = \sum_{i=1}^{i=n} \Delta_{Gi} \quad (5)$$

$$V_N = \sum_{i=1}^{i=n} (V' \times \Delta V_{Gi}) \quad (6)$$

$$S'_w = \frac{\sum_{j=1}^{i=m} S_{wi} \Delta V_{Gi}}{V_G} \quad (7)$$

$$S_{wav} = \frac{\sum_{j=1}^{j=m} S'_{wj} V_{Nj}}{\sum_{j=1}^{j=m} V_{Nj}} \quad (8)$$

Where:

A_x = Gross sand horizontal cross-sectional area at a contour, acres.

A_{Ti} = Area enclosed by a contour on the top of the sand, acres.

H' = Elevation in feet between oil-water contact and free-water level.

V' = Factor representing net sand as a fraction of gross sand.

n = Total number of areas contained between contours.

m = Total number of segments.

A_{Bi} = Area enclosed by a contour on the base of the sand, acres.

A_{xavg} = Average cross-sectional area between two successive contours, acres.

ΔV_{Gi} = Gross sand volume contained between two successive contours, acre-ft.

h' = Contour interval, ft.

V_G = Gross sand volume for segment, acre-ft.

V_{Nj} = Net sand volume for segment, $_j$ acre-ft.

S_{wi} = Avg. interstitial water saturation in sand volume contained between two successive contours, % pore volume.

S'_{wj} = Average interstitial water saturation for segment, $_j$ %.

S_{wav} = Average interstitial water saturation for reservoir, %.

H = Distance from oil-water contact to middle of sand volume, ΔV_{Gi}, ft.

h = Distance from free-water level to middle of sand volume, ΔV_{Gi}, ft.

SOLUTION:

Columns 4, 5, 6, and 7 of Table 1 show the computation of gross and net sand volumes. Note that column 4 is a solution of Equation 1, column 5 of Equation 2, column 6 of Equation 3, the total of column 6 of Equation 5, and the total of column 7 of Equation 6.

Columns 8 through 11 show calculations for average water saturation.

TABLE 1—AREAS MEASURED AND COMPUTATIONS FOR SAND VOLUMES AND WATER SATURATION IN SEGMENT 1

Measured data			Gross and net sand volume computation				Average water-saturation calculations			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Area enclosed, acres		Cross-sectional area, acres		Sand volume, acre-ft.					
Subsea depth, ft.	Top of sand	Base of sand	At each contour (2) − (3)	Average for two contours	Gross (5) × h' h'=10.0 ft.	Net (6)×0.7	Dist. from o/w to middle of sd. vol. increment, ft.	Dist. from free-water level to middle of sd. vol. increment, ft. (8)+100	Avg. water saturation at middle of sd. vol. increment, %	Gross sd. vol. times water saturation (6)×(10)
4,950 (G/o)	50	0	50							
4,960	55	2	53	51.5	515	360.5	75	175	32.5	16,738
4,970	65	12	53	53.0	530	371.0	65	165	33.3	17,649
4,980	80	22	58	55.5	555	388.5	55	155	34.2	18,981
4,990	90	32	58	58.0	580	406.0	45	145	35.0	20,300
5,000	105	44	61	59.5	595	416.5	35	135	35.8	21,301
5,010	125	59	66	63.5	635	444.5	25	125	36.8	23,368
5,020	135	74	61	63.5	635	444.5	15	115	37.8	24,003
5,030 (o/w)	145	94	51	56.0	560	392.0	5	105	38.9	21,784
					4,605	3,223.5				164,124

Congrats and $25 for this quip to Mrs. Merlyn Goodman, Rt. 5, Box 742, Shreveport, La.

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Column 9 is a solution of Equation 4 and the total of column 11 of the numerator of Equation 7. The values shown in column 10 were obtained from Fig. 4 of No. 24 in this series at the respective elevations shown in column 9. The average water saturation for the segment is obtained from Equation 7.

$$S'_w = \frac{164124}{4605} = 35.6\%$$

$$S_{wva} = [(0.356)\ (3,224) + (0.330)\ (3,050 + (0.350)\ (950) + (0.345)\ (1,580) + (0.305)\ (4,100)] \div [3,224 + 3,050 + 950 + 1,580 + 4,100] = [4,282.3] \div [12,904] = 0.332 \text{ or } 33.2\%$$

DISCUSSION:

This problem illustrates a method for determining water saturation in those reservoirs which are believed to contain reserves in the transition zone. In such cases an appreciable part of the recoverable oil may initially be situated in a zone from which both oil and water would be produced; i.e., at a subsurface elevation below the lowest point at which water-free oil will be produced. Consequently, an appreciable variation in water saturation may be involved going from the lowest elevation which would contribute recoverable oil to the higher areas of the reservoir. For instance, in segment 1 of the reservoir considered, the water saturation varied from 39.5% at the oil-water contact to 32.0% at the highest elevation. This segment lies in the interval between 100 and 180-ft. vertical elevation above the free-water level. It was necessary to develop the variation of gross sand-volume distribution in order to conform with the curvature of the average capillary-pressure curve (Fig. 4, No. 24 in this series). In this case volume increments over a vertical distance of 10 ft. were used. Thus it can be seen that for such a distance the curve can be represented by a straight-line increment.

This method of interstitial-water saturation determination is theoretically sound. However, difficulty is often encountered in obtaining sufficient data and in satisfying the assumptions made. Best results are obtained for a media of uniform permeability. Variations of permeability along the bedding plane will cause deviations. It is also believed that wettability may vary from point to point within a porous media.

Perhaps the most difficult thing to establish is the location of the free-water level. This is not normally a thing obtained in routine measure-

ments and thus generally may not be readily available. The elevation of the free-water level may be estimated by correlating the capillary-pressure water-saturation profile with the profile of water saturations determined from core analyses or electric-log computations, or both. Also the interfacial tension at reservoir conditions is normally not available. The latter can, however, be estimated from limited published data.[2]

References

1. Guerrero, E. T., and Stewart, F. M., Reservoir Engineering No. 24, The Oil and Gas Journal, July 4, 1960.
2. Hocott, C. R., "Interfacial Tension Between Water and Oil Under Reservoir Conditions," Trans. AIME, 1939, 132, 184.

BOOKS

PRINCIPLES OF GEOCHEMICAL PROSPECTING. By I. I. Ginsburg. Published by Pergamon Press, Inc., 122 E. Fifty-fifth Street, New York 22. 311 pp. $10.

This book constitutes the first effort to cover the entire subject of geochemical prospecting comprehensively, including hydrochemical, biogeochemical and geobotanical methods. It begins with a brief history of the development of the subject and a discussion of the principles on which it is based, followed by a generalized treatment of the subject of geochemical indicators.

The bulk of the book is devoted to a detailed discussion of geochemical search for the various kinds of ore deposits in igneous, metamorphic and sedimentary rocks and in surficial (residual) blankets. Examples have been chosen not only from the work of the author and his coworkers and the comprehensive Symposium on Geochemical Prospecting in the USSR, but also from the literature of the rest of the world.

Two chapters are devoted to haloes and other anomalies in overburden and soils, and the final chapter sums up the results obtained to date.

THE FIRST BIG OIL HUNT—VENEZUELA, 1911-1916. By Ralph Arnold, George A. Macready, and Thomas W. Barrington. Published by Vantage Press, Inc., 120 W. Thirty-first Street, New York City 1. 353 pp. $10.

They had no maps worthy of the name, virtually no stratigraphic or paleontologic data, no foundation on which to work. Living accommodations in the Venezuela hinterlands were **nil.** Health conditions were terrible—yellow fever, typhoid, malaria, amoebic dysentery were present. Such were some of the hazards facing Ralph Arnold and his associates in the greatest private geologic oil survey the world had known.

This book is a factual history of the organization and carrying out of that survey. When the work was begun, there was one oil well in the whole of Venezuela producing 40 gallons of oil per day; at the present time, Venezuela is the second largest oil-producing country in the world, with a yield of 2,500,000 barrels per day. A great majority of the producing fields of Venezuela were discovered by the Arnold Survey, the most extensive operation of its kind ever undertaken in South America.

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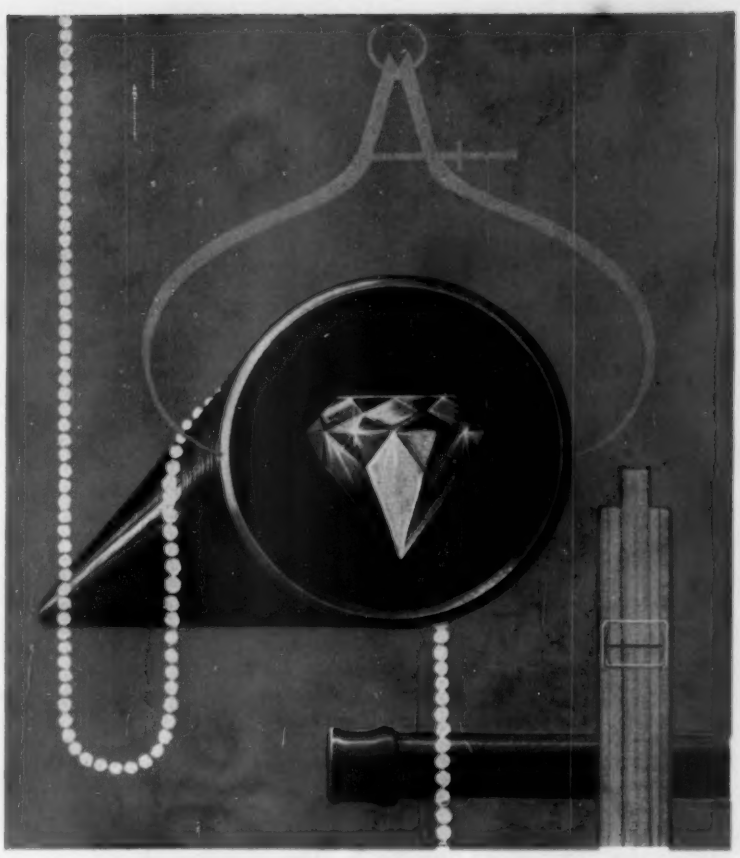

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How to measure pumping loads

BY JOSEPH ZABA

ONLY ACCURATE METHOD of determining the loadings on a sucker-rod string is by direct measurement. The instrument used for this purpose is the dynamometer. It permits determination of loads and furnishes means for analyzing the performance of the sucker-rod systems. The use of a dynamometer in diagnosing the performance of the pumping installations will be discussed in detail later in this series. At present, it is enough to say that the dynamometer furnishes a surface record of the instantaneous polished-rod loads at different times within the pumping cycle.

Dynamometer card. The record furnished by the dynamometer is called the dynamometer card. The load diagram on the card is recorded with the displacement of the rod as abscissa and the loads as ordinates.

If the rods were completely rigid, if there were no time lag in transmitting motion from the surface to the plunger, no dynamic effects, no vibration, no friction, and if each component of the system would perform with 100% efficiency, the dynamometer card would have the shape shown in Fig. 11-A.

As (a), the beginning of the upstroke, the traveling valve closes and the whole load is taken up instantaneously by the rods, from (a) to (b). During the upstroke, from (b) to (c) the load remains constant. At (c), the top of the upstroke, the traveling valve opens, the standing valve closes and the rods are unloaded, from (c) to (d). On the downstroke, from (d) to (a) the load remains constant.

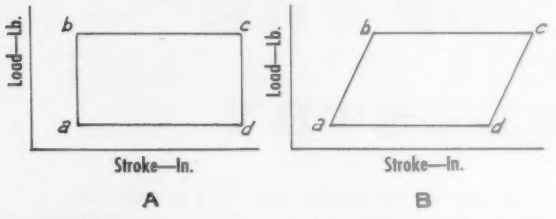
The sucker rods, however, are not rigid. They are elastic. They stretch under loads and they contract when unloaded. For a system in which the rods are elastic and other characteristics are the same as assumed above, the dynamometer card would have the shape shown in Fig. 11-B. With (a) the beginning of the upstroke, the maximum polished-rod load is not reached until (b). The gradual increase in load is a result of the stretch of rods.

During the upstroke, (b) to (c) the load remains constant. From (c), the beginning of the downstroke, the drop from the maximum to the minimum polished-rod load at (d) would be again gradual. This is a result of contraction of the rods, with fluid load being transferred to the tubing.

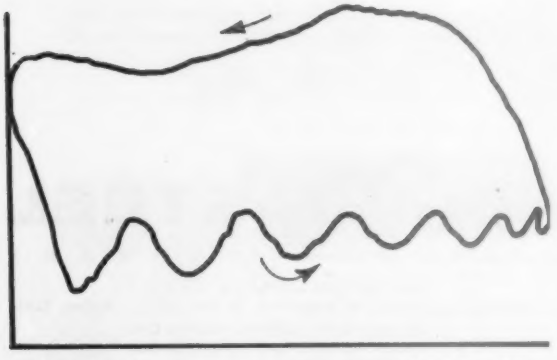
The card as described above is an ideal card, seldom, if ever, encountered in practice. It could be obtained on a relatively shallow well, pumping at a very slow speed with 100% volumetric efficiency of the pump and with all parts of the system performing properly.

Under all other conditions, however, presence of other than static loads distorts the shape of the card. Even at normal pumping speeds the dynamic effects may become quite pronounced. There is a time lag in transmission of the impulse from the plunger to the surface in deeper wells. The polished rod may travel through part of its stroke before picking up the load by the plunger is felt at the surface. The problem is further complicated by the natural vibration of the rods.

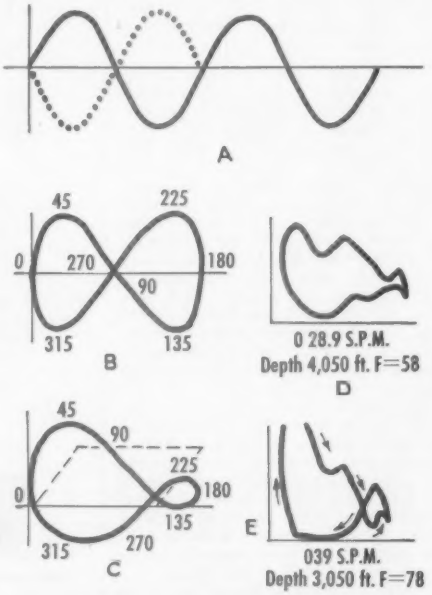
Effect of vibration. The effect of natural vibrations on the shape of dynamometer card was first analyzed



THEORETICAL dynanometer cards for nonelastic rods (A) and elastic rods (B). Fig. 11.



CARD showing vibrations on the downstroke. Fig. 13.



A, B, AND C show the steps in the design of a theoretical card for a rod string with a second order vibration. D and E are actual dynamometer cards from wells with second order vibrations. Fig. 12.

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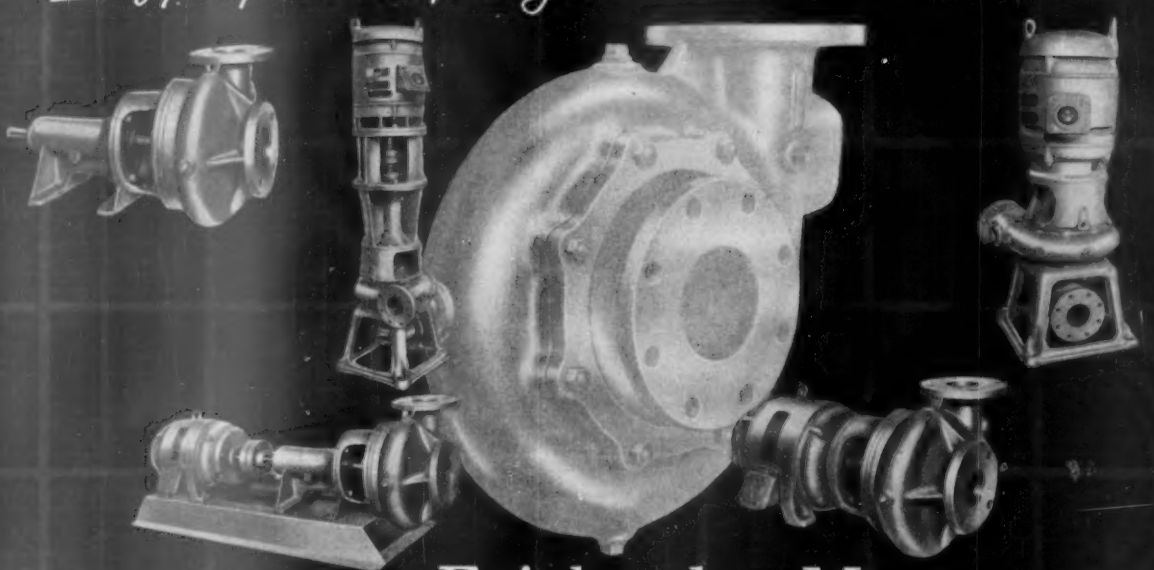

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and presented by J. C. Slonneger.[1] In this analysis he prepared cards for vibrations of different order by starting with a simple train of vibration, changing it to a continuous curve within the cycle, correcting for nonuniform motion of the rods and superimposing the parallelogram of forces needed for lifting the fluid. The result is a theoretical card for conditions of synchronous vibration. Other factors further distort such a card, but the general contour remains recognizable.

Fig. 12 shows the steps in making a theoreticard card for a vibration of second order. Fig. 12-A shows in solid line a simple train of two waves. If one of these waves were folded back, as shown by the dashed line, the two waves would make a continuous curve. In Fig. 12-B this curve is corrected to take care of the fact that displacement is larger in the middle than at the ends of the stroke. In Fig. 12-C forces needed to lift the fluid are shown by dashed line.

Adding the forces due to vibration and those needed to lift the fluid results in the card shown in Fig. 12-C in solid line. This is the theoretical card of the second order. Other factors distort the contour of the card. Figs. 12-D and 12-E show actual cards of second-order vibrations. Characteristics of such a card are: Concentration of the area of the card at the beginning of the upstroke, and the loop at the end of the upstroke.

In discussing the effects of vibration on shape of dynamometer cards, Mills and Corry pointed out the differences in these effects depending on the characteristics of the fluid.[2] If the fluid contains considerable gas, the release of load from the rods may be gradual enough so that only one set of vibrations is needed per cycle.

In pumping a gas-free liquid, two sets of vibrations per cycle are developed. If the ratio of the natural frequency of rods to the frequency of the pumping motion is an even number, the two trains of vibrations are 180° out of phase and have a tendency to cancel each other.

Fig. 13, reproduced from the above reference, shows a card pumping at a slow speed from a shallow depth. The vibrations are indicated on the downstroke. On the upstroke the vibrations set up by the closing of the traveling valve were 180° out of phase with vibrations existing in the string because of opening of the traveling valve, and were canceled out.

Bibliography

1. J. C. Slonneger, "Vibration Problems in Oil Wells": API Drilling and Production Practice, 1937, p. 179.

2. Kenneth N. Mills and S. E. Corry, "Effects of Rod Vibration and Dynamometer Cards": Oil Weekly, July 24, 1940.

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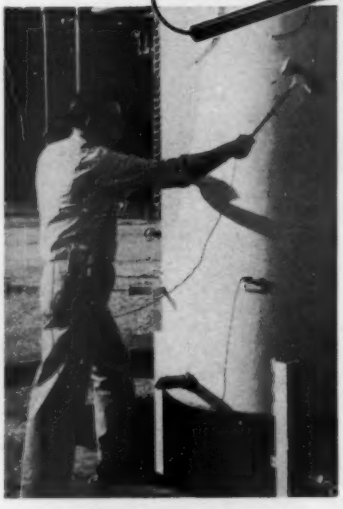

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Impurities show up as tiny white dots when viewed by this "magic" black box

• Pure's Research Center personnel have developed an accurate, quick means of determining jet-fuel cleanliness.

BY C. L. HEABERLIN
Research Chemist
J. M. FRASER
Senior Research Chemist
J. WALKER
Division Director
Pure Oil Co.

THE MYSTERIOUS "black box" that Pure Oil research technologists have been carrying as they travel to various airline terminals has created considerable interest. The black box has been found to be a valuable tool for monitoring jet-fuel cleanliness.

Cleanliness Is Vital

As everyone connected with the business of providing and using jet fuel knows, the cleanliness of jet fuel is a subject of great concern. Because of the huge quantities of jet fuel that are consumed by the thirsty jet engines, even very small amounts of solid particulate matter in the fuel can rapidly build up to serious proportions in critical locations in the fuel-handling system where extremely fine tolerances are maintained.

For example, the DC-8 has an engine fuel system operating at 1,200 psi. with fuel-control clearances of 0.0001 to 0.0007 in. Thus, it is clear that any solid particulate matter in the fuel can promote serious "wear and tear" in such a fuel system. This could result in the malfunctioning of the fuel-control system during flight, or in expensive overhauling resulting in the grounding of the aircraft.

Precautions Necessary

In view of the critical nature of this problem, extreme precautions are being taken by the manufacturers and distributors to insure the absence of significant amounts of particulate matter in their jet fuels. In the normal handling of a jet fuel from the time it leaves the refinery until it is pumped into the aircraft, the fuel may be filtered from four to six or more times.

Recently, Pure Oil Co. installed jet-fuel handling and storage facilities for Northwest Airlines at the Midway Airport in Chicago, the Milwaukee Airport, the Minneapolis Airport, and the Fargo Airport. In view of the extreme importance for having clean fuel-handling facilities, it was necessary to flush out these new systems with jet fuel in order to remove particulate matter before they were put into actual use. In doing this, the fuel used for flushing was to be checked until it was deemed that the particulate matter had been removed by the filters. A means for monitor-

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JET FUEL, some 420 g.p.m., goes into this Northwest turboprop Electra. The "black box" gives a quick, reliable, on-the-spot check of such fuels.

ing the fuel for particulate matter content was needed.

Method Developed

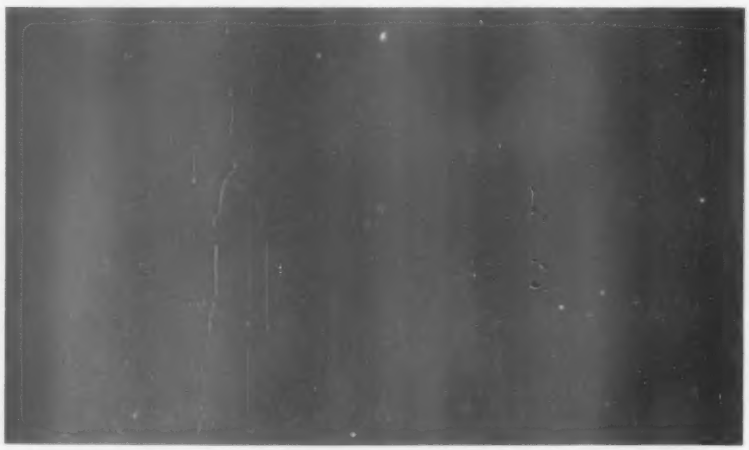
The American Society for Testing Materials has developed a "Method of Test for Particulate Matter in Hydrocarbons" which depends on filtering the fuel through a fine filter and then both weighing the dried filter and counting the particles under a microscope. Disadvantages to the use of this method are that it is not only a time-consuming procedure, requiring about 4 hours, but it also requires the facilities of a modern laboratory.

Pure Oil research men decided to develop a fast, reliable means for monitoring the particulate matter in jet fuel. This method was to be used to assist in determining the fuel cleanliness at airport facilities and was to be capable of giving rapid "on-the-spot" answers.

In the development of this test, it was decided to use the well-known "Tyndall effect," which is scattering of light by small particles. This is the phenomenon which makes visible a myriad of tiny dust particles in a ray of sunshine streaming into a darkened room.

How It Works

A black box was built which could exclude all light except from a powerful flashlight beam passing through a small window on one face of the box. A second opening in the box was provided to permit a view of the



SOLID PARTICLES of about 3 p.p.m. in jet fuel is spotted by the new Pure method. Compare this with the photograph on page 121, which shows only 1 p.p.m. of solid particles.

beam of light in a line at a 90° angle to it. The box was designed to accommodate a quart or gallon sample in a glass container. It was also constructed so that it could be opened out and folded flat for ease in carrying to field locations in a brief case.

In carrying out the test, the sample of fuel in the glass container is slightly agitated and then viewed by the human eye at right angles to the strong flashlight beam of light passing through the container. Particulate matter suspended in the fuel shows up in the beam of light as discrete, shiny particles. These tiny particles are not visible to the naked eye when the fuel is examined by looking through the glass container in ordinary daylight.

Using this technique at the airfields, checks on the fuel were made frequently and in a matter of seconds. When the cleanliness of the fuel being investigated was judged satisfactory by the black box test, samples were taken and returned to Pure's Research Center at Crystal Lake, Ill., for examination by the ASTM test. In every case, fuels passed by the black box and later tested by the ASTM method proved to contain far less particulate matter than the tolerable amounts.

Method Does the Job

Using the black box method the human eye can detect particles in concentrations as low as 0.1 p.p.m. This means that the total weight of all the particles in the fuel sample is only one ten-millionth of the weight of the fuel itself. This detectability (0.1 p.p.m.) is far less than the cleanliness requirement for fuel which most airlines are presently stipulating (0.25 to 4 p.p.m.).

Proper use of the black-box requires a certain amount of experience in learning what a fuel containing from 0.0 to 5 p.p.m. of particulate matter looks like. After the operator has been trained to recognize the appearance of a satisfactory fuel, he can apply the black box to any fuel, and easily can tell whether or not the fuel is clean enough to meet the requirements.

The black-box technique has proved very valuable in maintaining absolutely clean jet fuels, and it will be continued in use in the field for this purpose wherever Pure Oil jet fuels are handled.

Acknowledgment

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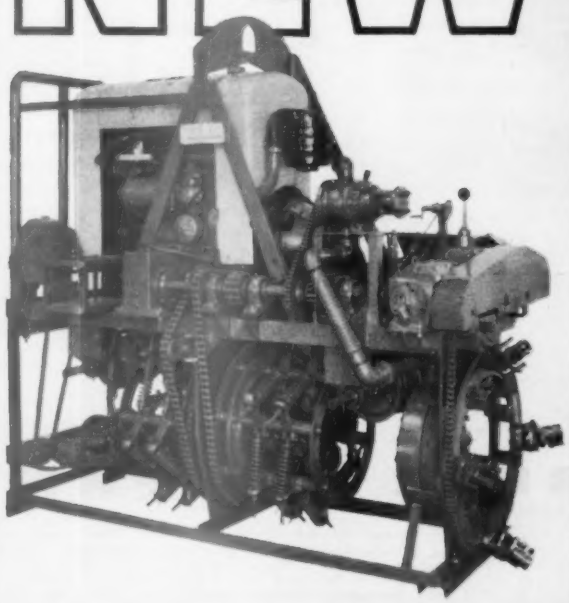

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This week's SHOWCASE features . . .

Trencher digs unattended

. . . according to the maker of this machine, called the Pup Utility trencher. The machine is self-powered, self-propelled, and portable. It digs 2 to 3 in. wide and 36 in. deep or 4 in. wide and to 18 in. deep.

Driven by a six-speed winch mechanism, the trencher draws itself down the line the user wants dug. To use the machine, merely drive a stake at the point to where the machine is to dig, hook on the winch line, and start the machine going. Source: **Davis Mfg. Inc., 1500 McLean Blvd., Wichita, Kans.**

The valve's floating seats each consist of two kinds of elastomer bonded to a metal seat insert. Soft elastomer for sealing is molded into the back of the ductile-iron insert ringed with holes. A tough elastomer is molded on the front or gate side. Source: **W-K-M Div. of ACF Industries, Inc., Box 2117, Houston 1.**

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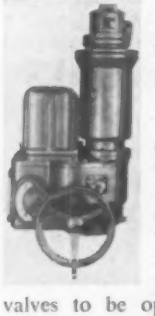
Valve actuator



. . . in two types made in England is available, (1) fully weatherproofed and (2) fully flameproofed and weatherproofed. According to the maker, the Model 120 actuator can be applied to any type or make of valve and can be fitted to the valve in place, permitting valves to be operated from control rooms or other convenient places with the valves at any required distance. The actuator comes with spur or worm-gear drive for valve-spindle torques from 30 to 3,500 lb.-ft. at 24 r.p.m. Source: **Jones Tate & Co., a branch of Dewrance & Co., Ltd., Victory Works, Bradford, England.**

●

Industrial cleaning is promised

. . . by a new chemical-action cleaner now available that mixes with water. Called Conco 1245, the product offers a way to prevent fire hazards and skin rashes attributable to industrial cleaners, the maker claims, as it is said to be nonflammable and nontoxic.

Requiring no special handling or precautions, according to the maker, the chemical cleaner can be used without danger on operating engines or near welding. Source: **Conco Chemical Co., Box 63, Dallas.**

●

Gate valve

. . . the Saf-T-Seal, comes in ASA 400 and 600 lb. classes. It provides a tight seal both up and downstream and needs no lubrication, the maker claims. Uses include petroleum gathering systems, oil, product, and gas-transmission lines.

Plastic coating

. . . protects valve for water-flood service against corrosion. The newest valve for water flooding and other secondary-recovery projects as well as for pressure maintenance systems has a plastic coating baked on the inside body surfaces. The plastic is a special formulation of phenolic, epoxy, and other resins designed to give corrosion protection against salt and sulfide waters. Field tests show, according to the maker, that the coating will not undercut or peel, even if it is mechanically broken.

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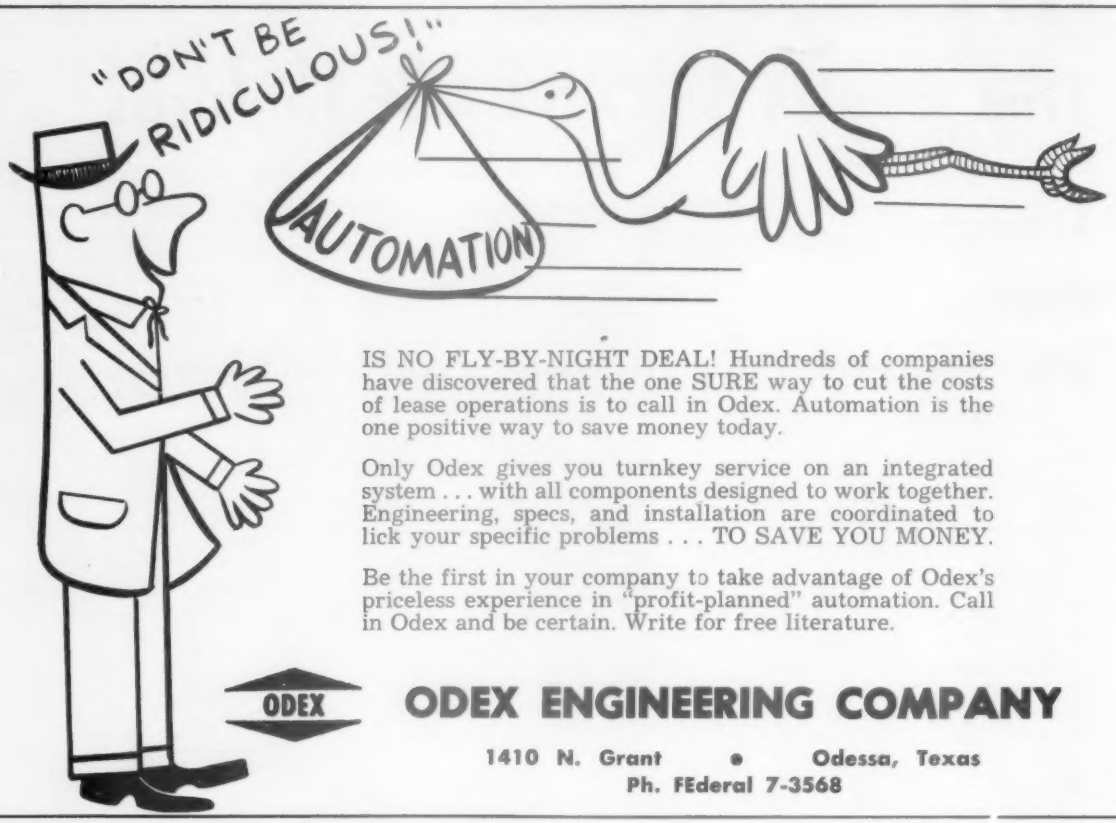

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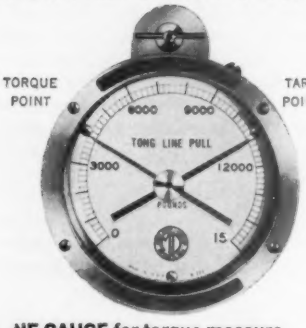
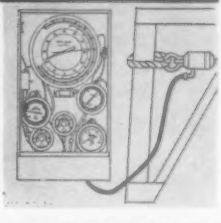
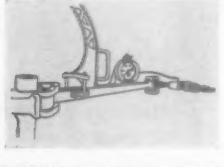




PERMANENT INSTALLATION
The cylinder attached to the back-up line provides torque indication each time collars are run.



PORTABLE INSTALLATION
The torque assembly attached to the tong itself can be used for spot checks on two or more rigs.

ONE GAUGE for torque measurements of all size drill collars, drill pipe, tubing and casing.

ACCURATE AND RELIABLE readings with calibration checks seldom required.

CARE AND MAINTENANCE can be capably done by the drilling crews.

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The Oil and Gas Journal

Box 1260 Tulsa, Oklahoma

Edward Valves, Inc., East Chicago, Ind.

•

Kit simplifies oil analysis

. . . permitting a complete oil analysis to be made in 12 minutes, the maker claims. The Akra-Ez kit provides an analysis of oil, including neutralization number, viscosity, water content, insoluble contaminants, metal contaminants, and temperature. Source: **R & W Engineering Co., 2118 West Cris Ave., Anaheim, Calif.**

•

Micromanometer

. . . on the market permits differential pressures as low as 0.0001 millimeter of mercury to be read directly on the panel meter. The Equibar pressure meter promises to be a versatile and useful tool for a variety of low differential pressure measurement, recording, and control applications. Eight full-scale ranges from 0.01 to 30 millimeter of mercury are selected by a front-panel switch. Source: **Trans-Sonics, Inc., Box 328, Lexington 73, Mass.**

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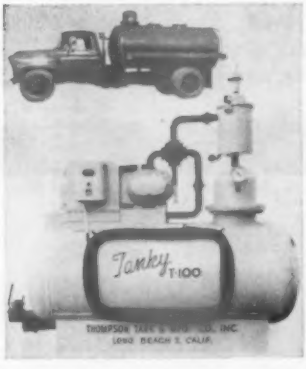

Unitized vacuum tank

. . . the Tanky T-100, comes in capacities of 100, 200, and 300 gal. and permits corrosive or abrasive liquids or semisolids to be loaded, transported, and unloaded by one man. Units are available caster-mounted, skid-mounted, truck-mounted, or trailer-mounted. Source: **Thompson Tank & Mfg. Co., Inc., 2019 E. Wardlow Rd., Long Beach 7, Calif.**

Compact tubing

. . . to API specs is available designed to reduce the cost of completing shallow to medium-depth wells. The API threads are interchangeable with existing API tubing in the field, the manufacturer reports.

In production of the tubing, one end of each joint is first upset so it can be threaded internally to form the box of the joint. The pin end of each joint is externally threaded. According to the manufacturer, use of the streamlined clearance joint eliminates the need for couplings in well tubing strings. Source: **Atlas Pipe Inc., 511 First, Houston.**

•

Chemical injector

. . . for oil wells being pumped is powered by the walking beam through a rod or cable connection to the operating arm on the injector. The Model UW injector comes with either a 2 or 5-gal. stainless-steel chemical tank with dustproof cover in maximum capacities from 2 pints to 11½ pints per day and with plunger sizes from 3/16 to 1/2 in. Source: **Udell, Inc., Box 18305, Houston 23.**

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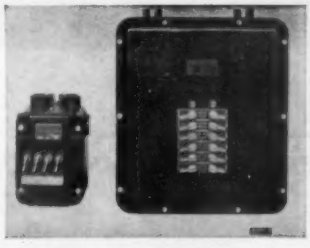

New lighting panels

. . . on the market come in two types. One type is a four-circuit lighting panel which is suitable for NEMA 4, 5, 7, and 9 use. Four cast hubs are provided. Mounting slots make installation easy on any type surface.

The other panel is a 12-circuit unit for use in NEMA 4, 5, and 9 applications. It is also available in a 24-circuit size. A feature of both lighting panels is the ease with which circuits can be added in the field up to the total capacity of the equipment. Source: **Nelson Electric Mfg. Co., Box 5385, Tulsa.**

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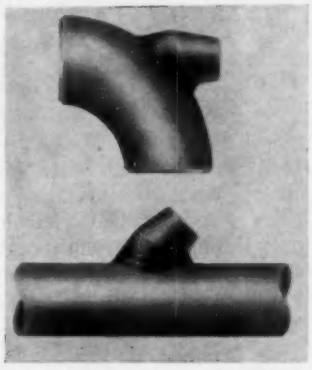


New fitting

. . . for branch joints now being produced is designed for use in attaching branch outlets at bends in piping systems. The Elbolet can also be used for angled connections to straight lines.

An advantage claimed for the fitting is that it provides substantially improved flow conditions compared with a 90-degree branch intersection made in any manner. According to the maker, the combination of angles on both the inside and outside of the fitting enables a full-penetration weld, even in the most acute angle section between the fitting and the run pipe. Compared with fabricated lateral fittings, the fitting speeds fabrication and cuts unit cost substantially, the maker claims. Source: **Bonney Forge & Tool Works, Allentown, Pa.**

•

New product

. . . to control viscosity and filtration in low-solids drilling fluids, now on the market, is a modified guar gum tradenamed Lo-Loss. According to the maker, it is particularly useful in low-solids fluids where the solids are kept to a minimum and the solids normally present do not give sufficient viscosity to lift cuttings and keep the hole clean or reduce the filtration.

Normal treatment consists of adding 1 to 2 lb. of the product per barrel of drilling fluid, depending upon the concentration of solids or on the concentration of salts in the brine making up the drilling fluid. The maker reports the product has been successfully used in the Rocky Mountain, Permian basin, and Mid-Continent areas. The product is packaged in multiwall paper bags containing 50 lb. Source: **Baroid Div., National Lead Co., Box 1675, Houston.**

A TALE OF TWO FLOODS

HOW TWO WATERFLOOD OPERATORS INCREASED

CASE NUMBER ONE

This major oil company, operating a shallow waterflood unit, was experiencing severe declines in some producing wells.

In 1956, five wells were fractured. Production increases were so encouraging that the fracturing program was continued. Results have been analyzed only through 1958, but recent experiences have been at least as good or better than earlier results.

During the three years under study, 52 producing wells were fractured by Dowell and 6-month tests were obtained.

Production before fracturing averaged 2.1 bopd for all 52 wells. Six months after fracturing, production averaged 19.5 bopd—an average increase of 17.4 bopd or a percentage increase of about 930 per cent.

In addition to the producing wells, many injection wells were also fractured so that increasing volumes of water could be handled with a minimum addition of wells and pumping equipment.

Three-month reports are available on 20 such injection wells. Before fracturing, the wells would take an average of 44 bwpd at line pressure. Three months after fracturing, they would take an average of 202 bwpd—a 4.6-fold increase.

No exact monetary value can be placed on this increase, but it is obvious that the system could handle more water without increases in equipment and power requirements.

CASE NUMBER TWO

This independent operator started flooding a Bartlesville sand pool that had been abandoned. The field was originally opened up in 1917 and had been depleted by primary methods.

Early in the flood, the operator found that conventional five-spot flooding of the central part of the pool did not yield economical production. A general policy was developed to inject water in the central part and drill producing wells around the periphery.

Apparently there was still considerable oil in place along the edges, but the relatively tight formation prevented profitable producing rates without fracturing.

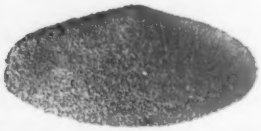
In 1952, the first two fracturing treatments were performed. Results were so encouraging that a systematic program of drilling and fracturing was started. By

THE STORY AT A GLANCE

- Location — **Eastern Kansas**
- Operated by — **a major oil company**
- Number of fracture treatments — **52**
- Average production per well before fracturing — **2.1 bopd**
- Average production per well **six months** after fracturing — **19.5 bopd**
- Average per cent increase in production — **930 per cent**
- Approximate cost of all treatments — **$27,000**

MORE IDEAS FROM DOWELL

TO HELP INCREASE PROFITS FROM SECONDARY RECOVERY



MAGNESIUM PELLETS

are often pumped into the formation before acidizing to heat the acid and melt away heavy hydrocarbons that might be blocking either injection or production. These treatments have proved remarkably successful.

ROCKSHOCK*

(Implosive formation treating service) is proving valuable both for formation cleaning and fracture initiation. It often makes possible the fracturing of formations that could not otherwise be fractured.

EZEFLO*

is a new Dowell surfactant. Available in bulk, it is especially useful for lowering water injection pressure. It is suitable for any use where an efficient, concentrated nonionic surfactant is indicated.

PROFITS WITH DOWELL STIMULATION SERVICES

THE STORY AT A GLANCE

- Location – **Eastern Kansas**
- Operated by – **an independent producer**
- Field had been abandoned before waterflood started
- Number of fracture treatments – **34**
- Cumulative production from fractured wells* – **866,512 barrels**
- Cost of fracturing* – **$25,828**
- Fracturing cost per barrel of oil – **3 cents**
- Fracturing cost as a percentage of total production cost – **less than two per cent**

*to December 31, 1959.

the end of 1959, 34 frac jobs had been performed at a total cost of approximately $25,828. All but a few of the earlier jobs were performed by Dowell.

Fracturing fluids, sizes of jobs and techniques were modernized and improved, as the program continued, to assure the operator of the greatest possible return on his investment.

Cumulative production from these wells totaled 866,512 barrels by the end of 1959. The net sales price of the oil was in excess of two million dollars. Cost of the fracturing treatments amounted to 3 cents per barrel of oil produced or less than two per cent of the total cost of producing the oil.

For this two per cent, the operator changed a flood that was headed for economic failure into an excellent financial success.

These field studies are just two more examples of how Dowell services can help operators improve production, keep down costs, improve profits and speed payout on investment.

You may run into a wide variety of problems in addition to oil production when you operate water disposal, gas injection or waterflood facilities. Your Dowell representative has a wide variety of services and products—both new and old—to help you solve your problems. A few examples are noted in the box below.

In addition to those services mentioned here, Dowell offers the Frac Guide*, the Acid Guide*, Cealment*, Corban* and Freflo* to help solve problems of secondary recovery. For more information on how Dowell can help you increase profits from your secondary recovery, pressure maintenance, water disposal or gas injection projects, **dial Dowell.** Dowell services and products are available from more than 150 offices and stations in the United States, Canada, Venezuela, Argentina and Germany. Dowell, Tulsa 1, Oklahoma. *Dowell Trademark

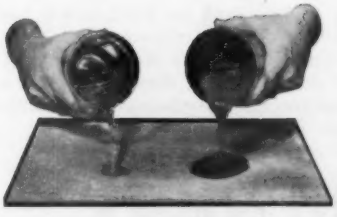
Services for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

ABRASIJET*

(Dowell-developed abrasive jetting service) can be used to initiate fractures, perforate or clean the formation face. On injection or disposal wells the result is often a good increase in receptibility and/or a lower injection pressure. On producing wells, the results have been higher production, better gas/oil or oil/water ratios or improved results from fracturing or acidizing.



STABILIZED ACID

is regular acid with a special addition agent to prevent the deposition of gummy iron or aluminum hydroxides which might otherwise plug formation pores.

GYPBAN*

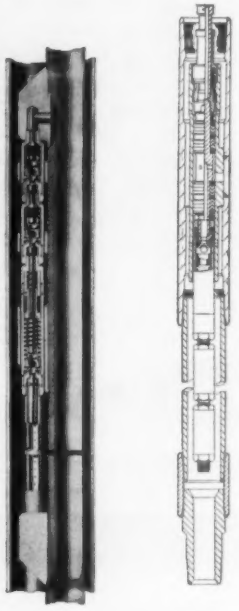
is a Dowell agent that is used to prevent formation plugging by water-formed gyp deposits. It is oil-insoluble and dissolves only gradually in water, thus providing months-long protection.

MACCO

MACCO BOTTOM HOLE CHEMICAL INJECTION VALVE

Down-hole chemical injection, a new patented method of combating corrosion.

Any well where the annular space may be filled with fluid lends itself readily to down-hole chemical injection. Introduction of the chemical into the flow stream of the well may be accomplished at any depth and under any normal conditions by means of a MACCO BOTTOM HOLE INJECTION VALVE ASSEMBLY. These assemblies are manufactured in several different types and are selected in accordance with the requirements for each particular installation.



Outside Mounted | Wireline Retrievable

For further information regarding the Macco method of down-hole chemical injection and types of equipment, write for Brochure No. 7-21.

MACCO equipment is also available in sterling areas from Williams & James (Oil Tools) Ltd., Gloucester, England

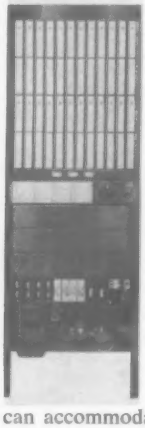
MACCO OIL TOOL COMPANY, INC.
1521 Prince, P.O. Box 7288, Houston 8, Tex.
Phone UN 1-1253

Additive to control preignition

. . . of gasoline, called Ignition Control Compound 4, is on the market, which the maker says is highly effective in controlling such automotive combustion problems as spark-plug fouling, surface ignition, and rumble. Chemically, the product is trimethyl phosphate.

According to the maker, extensive tests show that use of the compound in gasoline increased spark-plug life three to three and one-half times while reducing surface ignition and the incidence of rumble. Source: **Ethyl Corp., 100 Park Avenue, New York 17.**

Microwave functions



. . . with a new alarm system recently developed. The MA-1 alarm system monitors as many as 480 functions in a microwave system, indicating station condition, over-all system conditions, and individual function condition. Using the microwave radio frequency baseband for operation, the system consists of a master alarm station and a series of reporting stations. It can accommodate 24 stations with up to 20 functions each. Source: **Motorola, Inc., 4501 W. Augusta Blvd., Chicago 51.**

Corrosion inhibitor

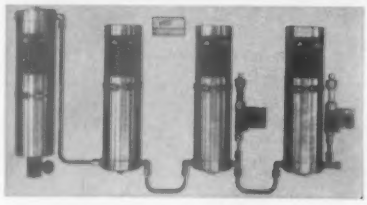
. . . called Dearborn 860 is nontoxic, and is for use in both open recirculating and once-through cooling systems where toxic contaminants such as chromate are not permitted by state and local regulations.

According to the manufacturer, in the dosages used, the product will not produce chemical concentrations that exceed public health service standards for potable water. Source: **Dearborn Chemical Co., Merchandise Mart, Chicago 54, Ill.**

Chemical to prevent fouling

. . . of refinery process equipment, Nalco 262, offers a way to reduce or eliminate potential deposit-forming materials that foul heat exchangers,

When water or oil in gases cannot be tolerated . . .



INSTALL ROBBINS

dehydration equipment

Robbins Aviation offers you both disposable cartridge type and refrigeration type dehydration systems for practically all types of gases . . . equipment designed and built to rigid quality control standards to give you maximum satisfaction in efficient trouble-free performance.

Robbins equipment is used extensively for aircraft pneumatic systems, test laboratory equipment, mobile compressor trailers, hydraulic system purging, missile charging and pressurizing systems, for instrument, laboratory, and factory air, controlled atmospheres for brazing and heat-treating furnaces, etc. Mechanical filters, drier and purifier chambers, refillable and disposable cartridges, dewpoint indicators also available.

Fast, positive, economical removal of water or oil vapor and impurities

Pressures to . . . . . 12,000 PSI
Safety Factor . . . . . 4 to 1
Dewpoints to . . . . . −100°F
Oil Vapor Removed to . . . as low as 0.3 ppm/w

Write today for complete information!

ROBBINS Aviation Inc.

Manufacturers of high quality valves and dehydration equipment

2350 E. 38th St., Los Angeles 58, Calif.
LUdlow 9-5221

furnaces, reboilers, and distillation columns, according to the maker. An amber-colored, hydrocarbon-soluble additive, it is injected into naphtha and gas-oil streams ahead of the point where fouling occurs. The maker reports that field tests showed the additive solved up to 90% of refinery equipment-fouling problems. Source: **Nalco Chemical Co., 6216 W. 66th Place, Chicago 38.**

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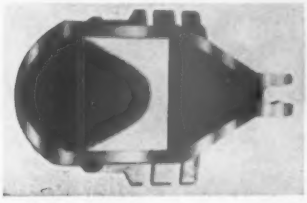

Perforating charge

. . . uses concentrated acid as the projectile. The "stinger" perforating charge uses the maker's velocity perforating principle to perforate casing, cement, and formation. At the same time, it places acid in each perforation. Advantage cited for the use of acid as the projectile is that it provides cleaner perforations and aids the effective permeability in the formation at the time of impact. Source: **Western Co., Box 186, Ft. Worth.**

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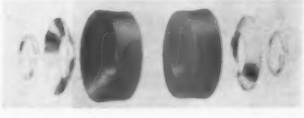


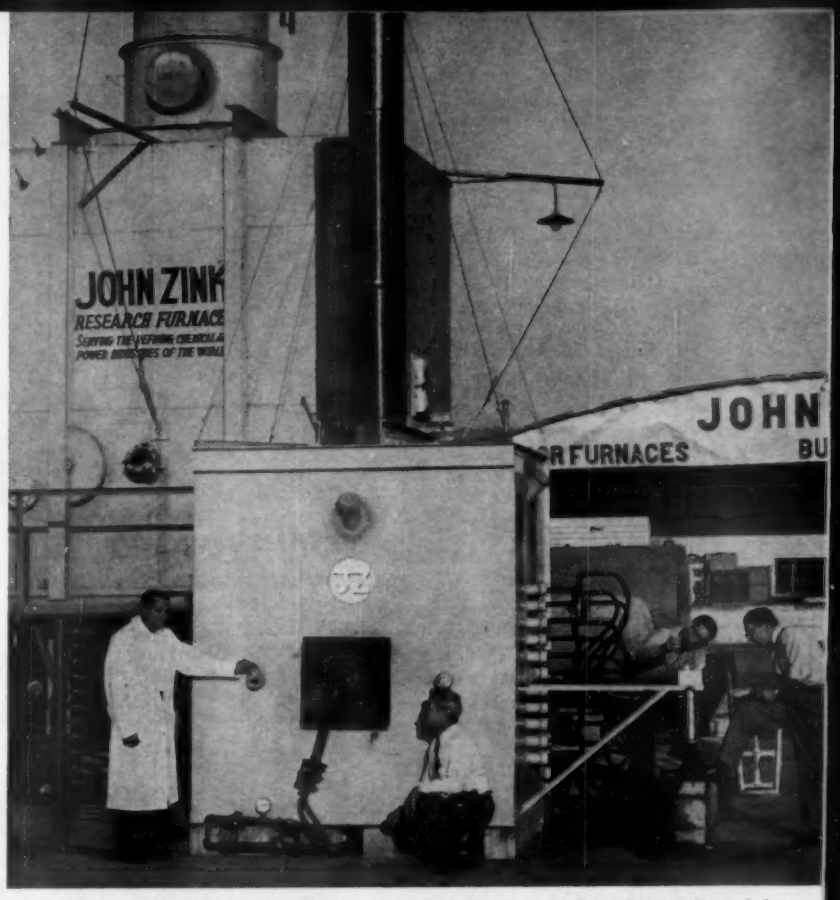
Pump pistons,

. . . replacement rubbers in a complete line are available for service with water-base drilling fluids. The new Regular rubbers are interchangeable on the maker's one-piece forged-steel piston hub which need not be removed from the rod when rubbers are replaced. The rubber is pressure-molded to numerous layers of thoroughly impregnated fabric reinforcement that resist separation due to the rubber fibers which bond the fabric layers together. The rubbers are available with inside diameters from 2½ to 3¾ in. Source: **Guiberson Corp., One of the Dresser Industries, Box 1106, Dallas.**

●

Automatic cathodic protection

. . . is possible with an Automatic Potential Control now on the market. The control provides, according to the



A portion of the John Zink Combustion Research Center . . . the large furnace is used for studying flame characteristics and the smaller one for studying heat transfer phenomena.

Q: How Can I ECONOMICALLY Increase Capacity In My Present Process Furnace?

A: Call The JOHN ZINK Company

More than likely, John Zink engineers can give you an immediate answer, since this is one of the process industry's constant problems. As leaders in the combustion engineering field, they probably have encountered and solved this problem for furnaces and processes like yours.
If your process or furnace presents a new, difficult, or unusual problem, the John Zink Company's outstanding test and research facilities can provide the right answer.

JOHN ZINK engineering and research can solve ANY combustion problem

The John Zink Company maintains the country's most complete test facilities, devoted exclusively to combustion research. These facilities are available to you for help with your combustion problems.

Write for Bulletin R-9, which gives detailed information on the facilities and services available.

JOHN ZINK
COMPANY
4401 S. PEORIA
TULSA, OKLAHOMA

Representatives in all major cities.

INDUSTRIAL BURNERS / AIR HEATERS / DISPOSAL UNITS
INERT GAS GENERATORS

maker, a continuous indication of the protective state of the structure, regulation of the applied current, retarding of coating deterioration, and conservation of power and anode material, and prevents overloading of d.c. rectifiers. The maker says the control can be applied to such installations as pipelines, offshore rigs, chemical processing equipment, and other applications. Source: **Electro Rust-Proofing Corp., 30 Main, Belleville 9, N. J.**

●

Adjustable-speed magnetic drive

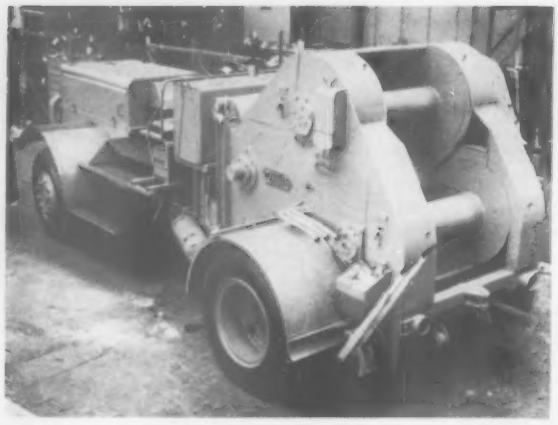
. . . in ratings from 75 to 4,000 hp. is on the market that features simplified design with few moving parts. It provides adjustable spread over an automatically regulated 20 to 1 range. Operating from a.c. power, the drive is based on a liquid-cooled magnetic coupling design that features stationary field construction and bearings that can be lubricated without disassembly. Source: **Louis Allis Co., 427 E. Stewart, Milwaukee 1.**

●

Accurate gas-density

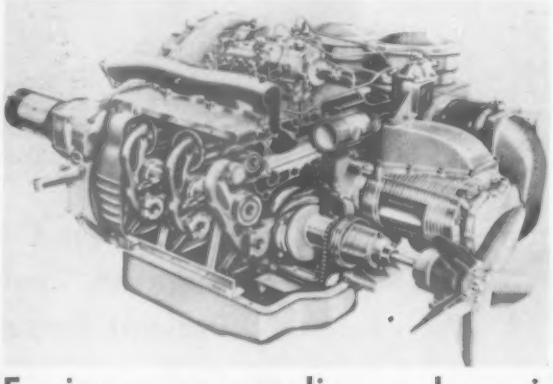
. . . measurement is promised by a new analyzer now available called the Whirlweigh densitometer. An output signal is continuously and instantaneously provided proportional to gas density, according to the maker. The instrument may be mounted directly on the maker's vortex velocity type of flowmeter to convert volumetric measurements to true mass flow measurement.

The densitometer is expected to prove valuable on natural-gas lines and for mass-flow measurements of ethylene and similar gases in petrochemical and other processing plants. Source: **Rotron Controls Corp., Woodstock, N. Y.**



Well-servicing hoist

. . . equipped with a hydraulic torque converter, made in England, is now being produced. The Fieldmaster TC hoist comes with a single-stage torque converter and provides easy control throughout the range of hoisting operations, according to the maker. It provides a shock-absorber element throughout the transmission which is expected to minimize the wear on chains and sprockets and other accessories. Source: **Woodfield Rochester, Ltd., Frindsbury Works, Rochester, Kent, England.**



Engine uses gasoline or kerosine

. . . as fuel, as well as diesel oil or jet fuel. The new Rootes engine will, according to the maker, allow utilization of the most economical fuel available in an area. The multifuel feature depends upon a special variable-pressure fuel-injection system which varies the amount of fuel fed into the combustion chamber according to the fuel used. The basic engine is a two-cycle, three-cylinder type designed to deliver 105 b.hp. Source: **Rootes Motors, Inc., 42-32 21st, Long Island City, N. Y.**

SHOWCASE . . .

New Literature

Special-service valves

. . . Catalog FE-138 (28 pages) describes and illustrates safety-relief valves for hydraulic pressure systems, liquefied gases, chemical corrosive service, and general industrial service. Sizing information, capacity tables, weights and dimensions, and application data are arranged to simplify selection. Source: **Farris Engineering Corp., 402 Commercial Ave., Palisades Park, N. J.**

Pneumatic pit-volume totalizer

. . . lends protection against mud loss and blowouts while recording true and permanent records of your mud operation, reports a new four-page bulletin now available. The literature tells how the device works, what it records, and includes questions and answers, special features, and informative photos. Source: **Bell Corp., P.O. Box 849, Odessa, Tex.**

Strand-laid wire-rope slings

. . . fabricated from high-carbon steel are covered in new comprehensive four-page Bulletin DH-425. It lists and tabulates construction details, advantages, and rated capacities. Source: **Wire-Rope Sling Dept., American Chain & Cable Co., Inc., Wilkes-Barre, Pa.**

Variable-capacity rotary pumps

. . . called Vari-Flow make it possible to "dial" any desired flow rate, from zero to full capacity, without changing pump speed, as described in Bulletin 600. The 8-page literature piece explains the principle of operation and includes cutaway illustrations of four basic models. Source: **Blackmer Pump Co., Grand Rapids 9, Mich.**

Pipe insulation

. . . molded of polyurethane foam for service between absolute zero and 250° F. is discussed in a new bulletin just published. The four-page bulletin gives complete thermal, mechanical, and chemical properties of the insulation, called Gem-Foam. Also detailed is the material's workability, mechanical strength, resistance to thermal shock, and flame vapor and chemical resistance. A table recommends thicknesses for various temperature ranges. Source: **Baldwin-Ehret-Hill, Inc., 500 Breunig Ave., Trenton 2, N. J.**

Mine and tunnel ventilation tubing

. . . tradenamed Flexipipe is the topic of a newly published 12-page brochure, now available free to interested parties. It outlines advantages of the tubing, diameters obtainable, and includes data on accessories, patching and repairing, and suspension hooks and collars. A friction-loss chart is included as are diagrammatic illustrations of the use of the tubing for shaft ventilation. Source: **Flexipipe Dept., Bemis Bro. Bag Co., 601 S. 4th St., St. Louis 2, Mo.**

Control-valve

. . . data sheet shows features of construction, optional accessories, and complete specifications on the Series LB control valve. It describes the LB valve as a single-seated, split-body valve with a powerful pneumatic-cylinder actuator and built-in positioner. Data Sheet 101 lists a variety of optional actuators and accessories which make the product suitable for any control-valve application. Source: **Conoflow Corp., 2100 Arch St., Philadelphia 3.**

Industrial-antioxidant

. . . applications of Tenamene 3 (2, 6-di-tert-butyl-p-cresol) are discussed in new 16-page Brochure I-107 now available. Performance charts and graphs illustrate the effectiveness of Tenamene 3 as an antioxidant for such materials as lubricating oils, turbine oil, paraffin wax, motor and aviation gasolines, rubber, elastomers, and polyethylene. Source: **Eastman Chemical Products, Inc., Kingsport, Tenn.**

"Canned" pumps

. . . for high-temperature fluids are discussed in obtainable two-page Bulletin 1040-4. It gives design features and operating curves on Series T sealless Chempumps for leakproof pumping of high-temperature fluids up to 1,000° F. Source: **Chempump Div., Fostoria Corp., Buck & County Line Roads, Dept. 61, Huntingdon Valley, Pa.**

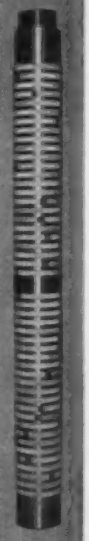
Let R-u-b-b-e-r Take The Wear

in your sucker rod pumps

IT COSTS YOU LESS THAT WAY

● MARTIN RUBBER & DUCK RINGS give excellent life in dirty abrasive fluids . . . high or low gravity . . . much or little water . . . shallow or deep wells. They last for years in the easier pumping wells. Replacement rings cost comparatively little.

● MARTIN PLUNGER BODIES, precision grooved, drilled and threaded (no underneath fluid passage), usually last for years. Tube or barrel costs are often cut in half.



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▶▶▶ Equipment Men Notes

Worthington names E. A. Bianchi

E. A. Bianchi

. . . to the post of general manager of its Mason-Neilan Division, announces L. C. Ricketts, Worthington's group vice president. The division, located at Norwood, Mass., manufactures automatic valves and instruments. Bianchi had been vice president—engineering and manufacturing of Mason-Neilan since 1956, when it became an operating division of Worthington. Prior to that, he was director of engineering for Mason-Neilan Regulator Co. Bianchi has been a director of Worthington-Canada the past 2 years.

Paul Eldridge is named manager

. . . of Nelson Electric Mfg. Co.'s eastern region. He worked the past 12 years in the east for General Electric Co. Eldridge will headquarter in Boston.

J&L Steel Corp. appoints

. . . Western Supply Co., of Tulsa, as a distributor of oil-country pipe and tubular goods, reports J. E. Timberlake, vice president in charge of sales for Jones & Laughlin. Western will be one of four distributors for J&L tubular goods. The Tulsa firm maintains sales offices in Dallas, Houston, and Tyler; and stores at Longview, Odessa, and Pampa, Tex.

Dwight G. Barnhart is promoted

D. G. Barnhart

. . . to sales manager of Fibercast Co., a reinforced epoxy-resin pipe and fittings manufacturer operated by Continental-Emsco Co. Both are divisions of Youngstown Sheet & Tube Co.

Barnhart, formerly district tubular representative for C-E, will locate at Fibercast's plant in Sand Springs, Okla. He will report to C-E Vice President Craig Smyser, who is serving as general manager of Fibercast.

Walter J. Slaughter becomes

W. J. Slaughter

. . . Oklahoma district manager of Republic Supply Co. at Oklahoma City, announces C. J. Jump, general sales manager. Slaughter formerly was western division manager of Parkersburg Rig & Reel Co., with headquarters at Tulsa. More recently he served as manager of the Rocky Mountain division at Denver.

Meanwhile, W. E. Levell was named assistant manager of the Oklahoma district. He had been serving as a special sales representative in Oklahoma for Republic the past year.

WECO'S ANNUAL SALES MEETING, held recently at the firm's offices and plant in Houston, was devoted primarily to a discussion of company products. Attending the Well Equipment Mfg. Corp. gathering were, front row from left: J. C. McCelvey, R. L. Reininger, George West, Joe Viator, M. M. Bowen, J. R. Thrasher, and Jack Powers; middle row, Tom S. Andrews, Sr., Cleo Williamson, John W. Gates (vice president and sales manager), C. V. Marshall, W. H. Brien, Jarvis Watson, M. D. Lewis, and Jack Runnells; back row, Tom S. Andrews, Jr., Charles E. Gisler, J. A. McCreary, Foster Jordan, S. W. Lomax, A. H. Watts, T. R. Shields, W. C. Meeks, and Clark Armold.

Garrett Oil Tools appoints

. . . a number of new foreign agents to handle sales of equipment in various overseas areas.

James Bayliss, Brisbane, Australia, will represent the division of U. S. Industries, Inc. in Indonesia, Borneo, Australia, New Guinea, New Zealand, and The Philippines. In West Germany, Garrett will be represented by Edeco Germany, G.M.B.H., of Hamburg. In Spain and the Spanish Sahara, the new agent is Anglo-Espanola de Electricidad, S.A., Barcelona.

Macridge Petroleum Equipment-Supply Co., S.A.L., Beirut, Lebanon, has been named representative for Lebanon, Bahrein, Saudi Arabia, Kuwait, Syria, Jordan, Greece, Oman, Neutral Zone, and Qatar. The new agent for Trinidad is British Scientific Co., San Fernando, Trinidad.

Rawson & Co., Inc. opens office

. . . in Beaumont to serve as a sales and service point, under the direction of William S. Knoble. Knoble's experience includes 7 years in technical and engineering departments at Mobil's Beaumont refinery.

Included in the Rawson line are pressure gages, Brodie meters, Dynatrol level density and viscosity systems, Petro-Chem fired heaters, Stratco alkylation units, and Ducon catalyst recovery cyclones.

Carl W. Brown joins Macco

. . . Oil Tool Co., Inc. as chief petroleum engineer. He was employed previously by Atlantic Refining Co. for 6 years. While there his work consisted of reservoir and production engineering.

Welex, Inc. opens district office

. . . in Shreveport under the supervision of Carl Starrett, district manager, who also supervises the Tyler, Tex. district office. Engineer in charge of the Shreveport location is W. H. Taylor. J. W. Pickering, district manager, heads the Tyler station.

Caldrill, Inc. purchases

. . . through U. S. Steel's Oil Well Supply Division a diesel-electric drilling rig drive package to be placed in operation on Texaco's permanent offshore platform near Gaviota, Calif.

The equipment section of General Electric Co.'s locomotive and car-equipment department, Erie, Pa., will furnish drilling motors, generators, and control equipment.

The S-455 drilling-rig drive package consists of four GE-752 drilling gen-

erators each rated 600 hp. input at 1,200 r.p.m. and five GE-752 drilling motors each capable of delivering 1,000 hp. for hoisting, or 700 hp. for pumping. There are two 33 kv. d.c. exciters — one furnishing excitation and control power for the system, while the other is a standby.

Peter A. MacQueen joins

P. A. MacQueen

... the oil load division of the Fort Worth National Bank, according to J. E. McKinney, chairman of the executive committee and chief executive officer, and Lewis H. Bond, president. A petroleum engineer, MacQueen previously was employed by Shell Oil Co.

George E. Matter to represent

... Hillman-Kelley's oil-well supplies and power tong equipment, with headquarters at the company's head office in Los Angeles. Prior to his new post, Matter was division manager for Houston Oil Field Material Co. at the firm's Long Beach office for 17 years, and was in charge of Homco's operations in Venezuela for 2 years.

Leschen Wire Rope opens office

... and warehouse in Oklahoma City for service to customers and distributors. The office will serve as headquarters for the midwest sales district, and will be under the jurisdiction of Hugh Bergin, district sales manager. Leschen Wire Rope is a division of H. K. Porter Co., Inc.

Wyman L. Taylor is promoted

... to the position of assistant to the vice president of sales, Industrial Chemicals Division, Stauffer Chemical Co. Taylor, who joined Stauffer 14 years ago, was previously western sales manager of the division, and was located in San Francisco. He will now be located in New York.

NGSMA installs new officers

... and board members at the annual Natural Gasoline Supply Men's Association board meeting held recently in Tulsa. Those taking office were: Ray F. Riddle, Riddle & Hubbell Co., Tulsa, president; C. P. Stanley, Dresser Engineering Co., Tulsa, first vice president; F. W. Bell, Brown & Root, Inc., Houston, second vice president; and W. M. Gebo, Ingersoll-Rand Co., Tulsa, treasurer. William F. Lowe was reelected secretary.

Elected to the board for a 2-year

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JERRY GORDON, Vice Pres.
TONY DE CARLO, Gen. Mgr.

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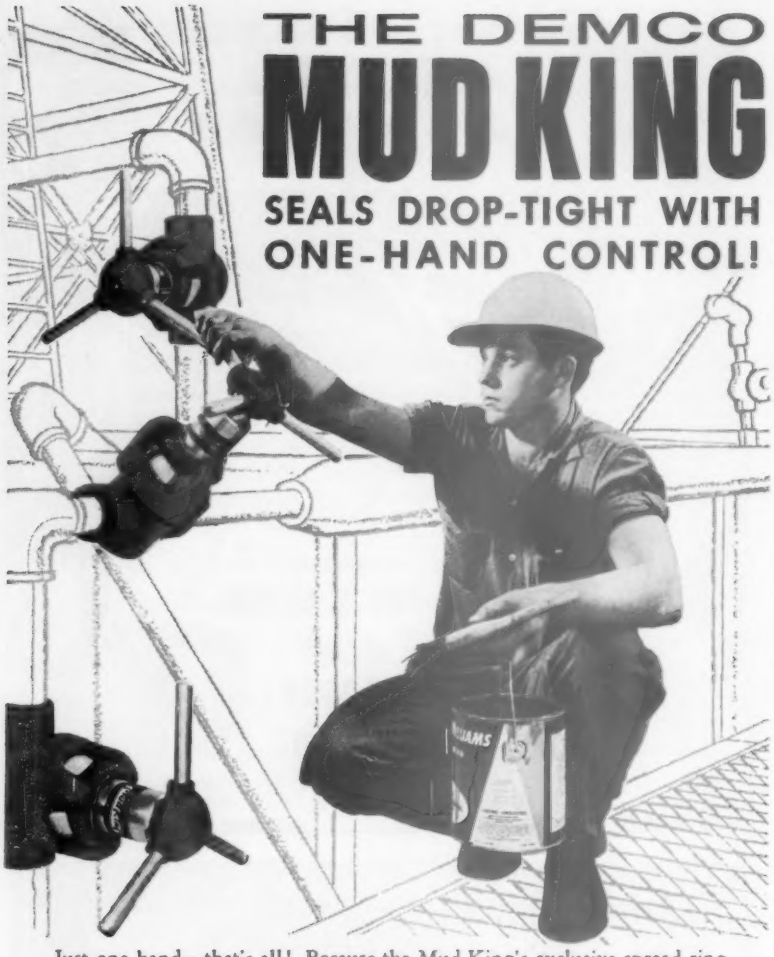

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term were: Fred Blackbird, Crane Packing Co., Houston; John N. Brown, Brown Fintube Co., Elyria, Ohio; C. L. Bryan, Gasoline Plant Construction Corp., Houston; A. F. Canada, Jr., Pacific Pumps, Inc., Huntington Park, Calif.; W. A. Carroll, Jr., Burgess-Manning Co., Dallas; T. R. Cross, Paramount Supply Co., Amarillo; James E. Hughes, Western Supply Co., Tulsa; W. F. Matheny, Aimco Products Corp., Tulsa; I. Earl Nutter, Nutter Engineering Co., Tulsa; E. L. Stark, Foxboro Co., Dallas; and Rudy Zorn, Cameron Iron Works, Inc., Houston.

Beckman Instruments to operate

. . . two new Swiss subsidiaries which will serve as headquarters for the company's foreign sales and manufacturing activities.

The subsidiaries are Beckman Instruments International, S.A., and Beckman Instruments Investment, S.A. The first is an operating company which will coordinate Beckman's overseas marketing operations. The second is a holding company which will own the operating firm and existing Beckman subsidiaries in Munich, Germany and in Glenrothes, Scotland.

McCullough Tool Co. opens

. . . a new district service location in McCook, Neb., which will operate under Adrain Fitzsimmons, district sales and service manager. The new location will be under the supervision of W. A. McCullough, division sales and service manager of the Mountain division in Casper.

AMALOG INSPECTION UNIT provides an automatic, electro-magnetic inspection technique for locating and evaluating defects in new casing, tubing, and drill pipe. Tuboscope Co.'s inspection facility is located at Walker's Mill, Pa.

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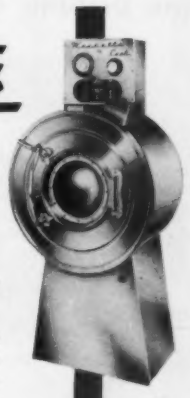

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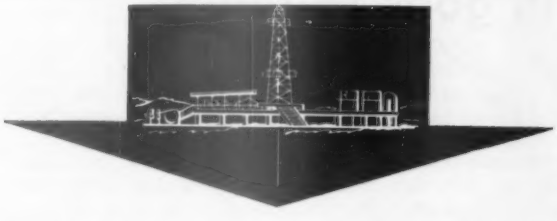

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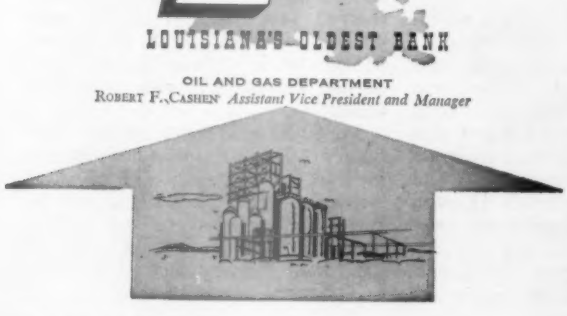
ROBERT F. CASHEN *Assistant Vice President and Manager*



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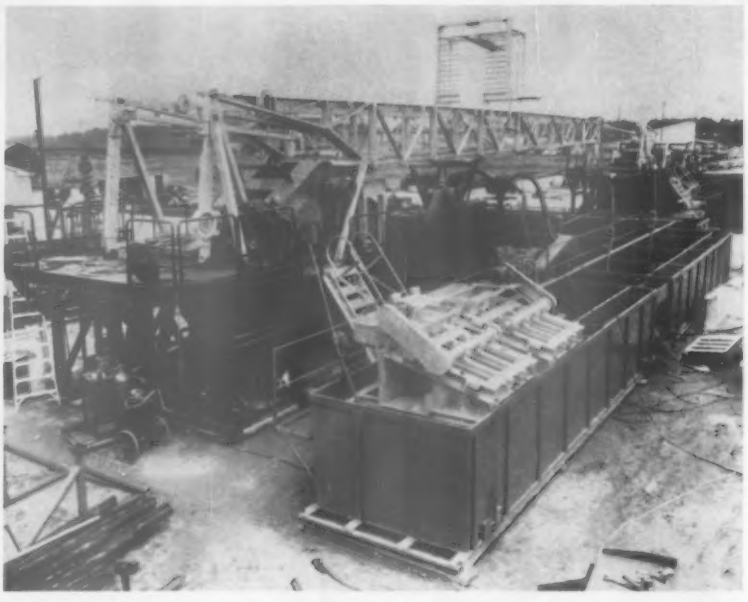


OFF TO INDIA this rig will go after final testing in Houston. It is one of two National T-45's slated for the India Supply Mission. Mud tanks and shale shaker are in the foreground, while at left rear is the substructure, with 97-ft. mast folded down over the draw works and other components. Rigup for second T-45 unit is in right rear.

Drilling rig goes to India

ONE OF THE LARGEST single shipments of oil-well-drilling equipment from the United States to India was made recently.

During the rigup at Houston before shipment, all components of each rig were put in place, and all pipes, hoses, and wiring connected. After test operation the rigs were disassembled and the components boxed for shipment. Russell Wisecup, drilling-equipment engineer for National Supply's export division, will assist in assembling the rigs at their location in India.

The shipment, reported by the export division, includes two trailer-mounted drilling rigs, complete with 97-ft. masts and power equipment, drill pipe, and 66,800 ft. of steel casing.

Most of the machinery and equipment was manufactured by National in its plants at Torrance, Calif., and Gainesville, Tex., and the pipe was produced in its seamless tubular mill at Ambridge, Pa. The rigs, which also included components from other manufacturers, were rigged up and test-assembled at the firm's Houston plant before being loaded on shipboard at that seaport.

The rigs are National T-45's, normally considered for drilling in the 4,500-7,500-ft. depth range. Equipment for each rig includes the T-45 draw works, Type SA-175 rotary machine, Type N-35 swivel, Type 430-E-140 hook-block, Type C-250 slush pump, Type C-150-B slush pump, and an independent pump drive for use with the C-150-B pump.

Products of other manufacturers for each rig include three General Motors 12107 diesel engnies (two for powering the rig and one for the independent slush pump), a Lee C. Moore mast, and single trailer assembly mounted on Athey tracks to be drawn by a Caterpillar tractor.

The casing shipped includes 52,800 ft. of 5½-in., 12,800 ft. of 9⅝-in., and 1,200 ft. of 13⅜-in. all Spang API casing. Other tubular products shipped were 16 drill collars, each 4¾-in. diameter by 30 ft., and 14,000 ft. of 3½-in. Spang Double Seal Shrink Thread drill pipe with tool joints.

M. S. Ram, director of the India Supply Mission, inspected the equipment at the rigup yard. On arrival at Bombay, India, the material will be carried by railroad to the drilling area near Cambay. Greaves Cotton & Co., Ltd., Bombay and New Delhi, are National agents in India.

Hupp interests sold to Kentuckians

THE INTERESTS of three firms which were owned by Hupp have been sold to five Owensboro, Ky., men. The companies are Hupp Oil Co., Triple H Drilling Co., and Hupp & Hume Drilling Co.

Upon the transfer of assets by Mrs. Genavive J. Hagerman, widow of Robert E. Hupp, to the new owners, two new firms were formed. They are Har-Ken Oil Co. and Crescent Drilling Co. Triple H. Drilling Co. will retain its name under the new management.

The five purchasers include: H. Warren Hartsough, Karl Z. Wilking, Charles D. Ralph, E. E. "Mike" Cheeseman, and Clifford E. Sturgis. They own and manage both Har-Ken and Crescent Drilling.

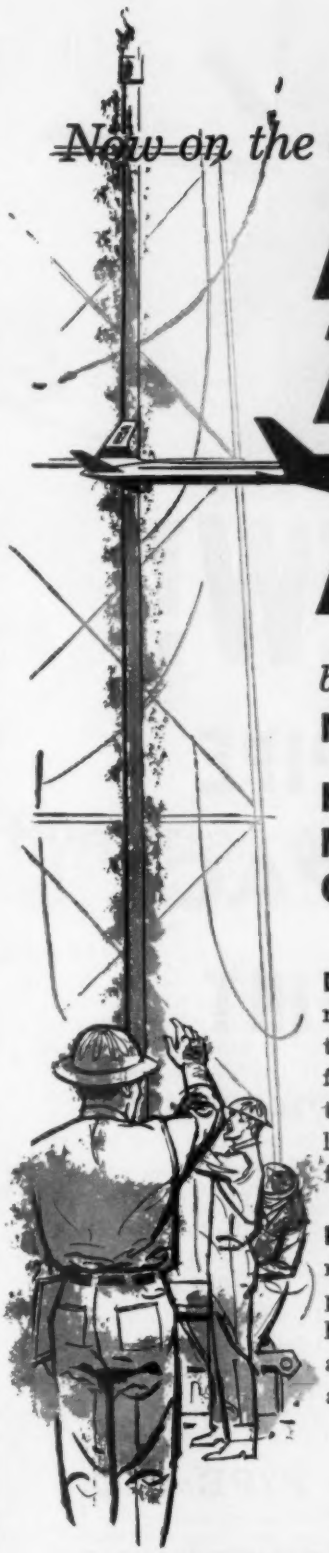
Active Rigs*

	Rotary	Cable	Total†
Alabama	4	0	4
Alaska	5	0	5
Arizona	1	0	1
Arkansas, South	29	0	29
California, Inland	102	1	103
Colo., excl. Four Corners	16	4	20
Four Corners	7	0	7
Florida	2	0	2
Georgia	2	0	2
Idaho	0	0	0
Illinois	47	27	74
Indiana	11	23	34
Kansas	103	24	127
Kentucky, Western	9	41	50
Louisiana, North	101	0	101
South Inland	225	0	225
Mississippi	53	0	53
Montana	24	2	26
Nebraska, West	25	0	25
Nevada	2	1	3
New Mexico, East	87	23	110
New Mexico, West	30	6	36
North Dakota	19	0	19
Okla., excl. Panhandle	246	66	312
Panhandle	25	9	34
Oregon	0	1	1
South Dakota	1	2	3
Texas, Offshore	2	0	2
East	68	0	68
U. Gulf Coast	104	0	104
North	111	3	114
Panhandle	56	11	67
S.W., Corpus Christi	137	0	137
S.W., San Antonio	33	1	34
West	217	23	240
West Central	79	16	95
Utah, North	14	0	14
South	19	0	19
Washington	1	0	1
Wyoming	65	6	71
Reported U. S. Total	**2,082**	**290**	**2,372**

*Report to AAODC by the International Oil Scouts Association.

†As of July 1, 1960.

Not reported this week: Calif. offshore, Iowa, La. offshore, Mich., Mo., Neb. east.



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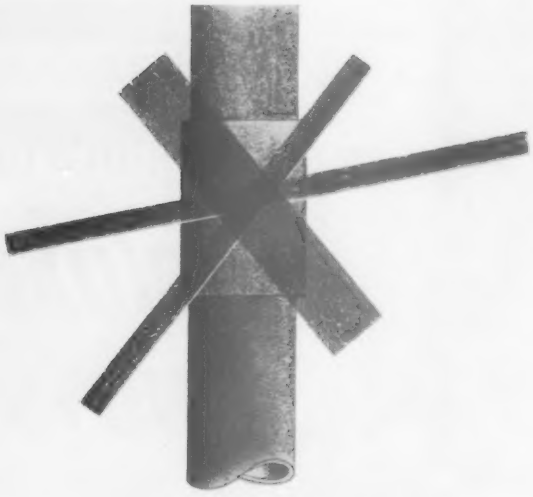

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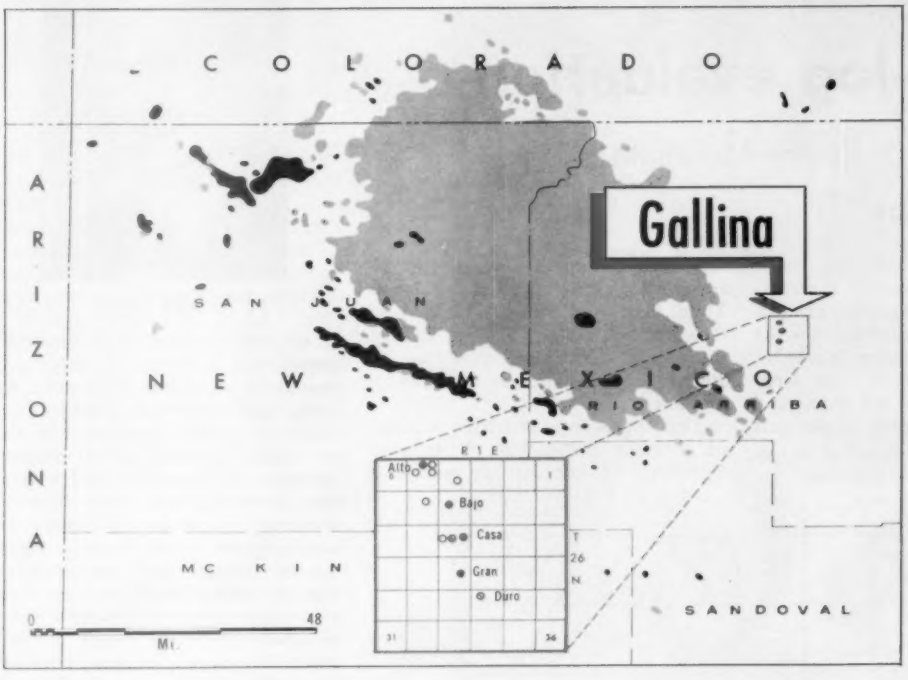


FIVE EXPLORATORY WELLS have been drilled by Intex Oil Co., in Rio Arriba County, New Mexico, and every one was a hit. The field, first called Gallina, now named Puerto Chiquito, is the first oil production on the east flank of the San Juan basin.

Five hits in five tries at Gallina

BY FRANK J. GARDNER

ONE OF THE most interesting exploration programs in the country is also the most rewarding. To drill five exploratory wells in unexplored country and score five hits is something most oil men just dream about.

But Intex Oil Co., a California independent, has done just that. On the far east rim of the San Juan basin in Rio Arriba County, New Mexico, this operator, by stepping out a mile or so at a time, has charted a new field which may turn out to be much more important than the original discovery indicated. The five wells snake across 26n-1e in a north-south arc now 4½ miles long. And they lie 7,000 to 7,500 ft. above sea level.

Five down and seven to go . . . These are shallow cable-tool wells, with pay targets (three of them) all above 3,500 ft. So far, the price tag has run about $30,000 per well. They lie 10½ miles northeast of the nearest production on the east flank of Gavilan gas field. Besides the first five producers, Intex has locations staked for six new tests, and is drilling at one, the 1-16 USL-Fino.

The discovery, 1 USL-Alto, was finished on pump last February 29 for 130 bbl. per day. Production was from fractured Niobrara-Cretaceous shales, first of its kind in this region. Pay depth was 1,929-58 ft. Intex had aimed the drill at the Greenhorn-Cretaceous, about 800 ft. deeper than the Niobrara, but when the shallower oil was found, completion was made at that level with total depth 1,958 ft. Location was in Section 5.

Stepping out a bit more than a mile to the southeast, Intex staked the second well, 1 USL-Bajo, in Section 9. While not as good as the Alto, this one opened a second pay zone in the Sanastee-Cretaceous at 2,345-50 ft. Initial pumping potential was 28 bbl. per day. Total depth was 2,357 ft.

A second stepout a mile southeast of 1 USL-Bajo was 1 USL-Casa in Section 16. This third producer was another Niobrara well at 2,078-2,185 ft. It was drilled to 2,876 ft., then sidetracked at 1,990 ft. and drilled to 2,185 ft. Final pump potential was 41 bbl. per day.

Still in the testing stages are the fourth and fifth wells, 1 and 2 miles, respectively, south of the 1 USL-Casa. The 1 USL-Gran is an indicated Greenhorn producer, and deepest hole in the field so far, with total depth of 3,478 ft. Location in Section 21. Evidently at 3,425-78 ft., it is to be the first Greenhorn producer in the field. On 20-hour pump test, the Gran made 78 bbl. per day.

Intex 1 USL-Duro, southernmost indicated producer, lies in Section 27. It, too, has showed oil from Greenhorn at total depth 2,745 ft. Operator is installing pump and production gages have not been made.

Shouldn't be overlooked . . . This multipay field is a forerunner of things to come. We will see the day when the San Juan basin is completely encircled by narrow, elongated oil pools in stratigraphic traps along its flanks. It's already happened on the western and southern flanks. And it will happen on the east and north.

As geologist Harrell Budd put it in his 1959 summary of San Juan exploration (AAPG Bulletin, June 1960, p. 892), in referring to small strikes on the south flank of the basin: "These small discoveries, however insignificant, do indicate an oil and gas potential that many are inclined to overlook."

PART 1 OF 2 PARTS

Using

Electric-log evaluation

In exploring for Rocky Mountain petroleum traps

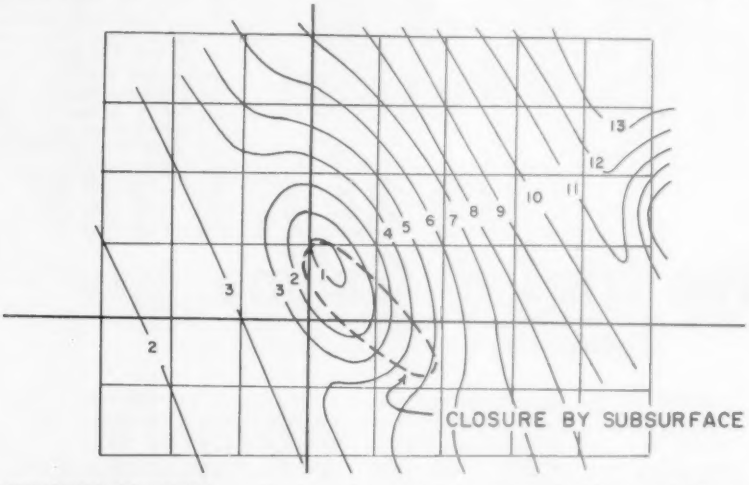
BY BOB JONES

. . . who has written several technical papers and is an active member of several professional societies. Bob Jones is a consultant specializing in electrical reservoir evaluation in Casper, Wyo. Formerly he was a district manager at Casper for Schlumberger Well Surveying Corp., was with Mountain States Tel. & Tel., in Denver, and was affiliated with Western Electric Co. in Chicago. He was graduated from the University of Colorado as an electrical engineer in 1940, and studied advanced electronics at MIT. While in the U. S. Navy, he was graduated from MIT in 1942. He has maintained his own office since 1957.

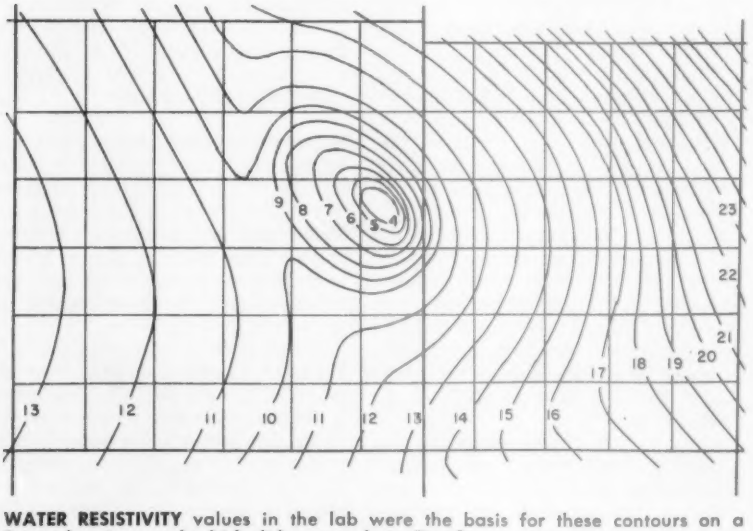
ELECTRIC LOGS have for many years been used extensively in oil exploration. Most wide uses are analysis of the stratigraphic section, solving environments, and studying deposition and structural conditions. The large majority of these logs are untouched with respect to evaluation of physical formation parameters which can be applied to verify existing oil traps. These hold real promise as keys to the location of new oil traps. It is in the use of these parameters that an entirely new exploration approach is presented.

Presented before the Society of Professional Well Log Analysts, May 1960.

This approach is restricted to areas of previous drilling but it is most significant to note that the method is based upon use of the electric log only, thereby providing control from nearly all wells in which the electric log has been run. Special porosity and focused logs are of course desirable and must be used, when available, to refine accuracy; but SP logging upon which much of this technique is based, has remained of quite consistent quality through development history in logging.



STRUCTURE CONTOURS on the top of a productive Pennsylvanian sand shown here were obtained from values derived from laboratory water-analysis samples. Fig. 1.



WATER RESISTIVITY values in the lab were the basis for these contours on a Pennsylvanian sand which did not produce. Fig. 2.

Briefly, log evaluation determines two important items: first, a relative factor of formation-water salinity within a porous formation; and, second, by computation, a relative rating as to quality of hydrocarbon shows existing in the pore space. When mapped, and considered with known data derived from present techniques of exploration, these items can confirm or deny the presence of efficient oil entrapment. These log-calculated parameters are effective in delineating formation traps, regardless of whether the traps exist because of stratigraphic changes, faulting, or structural relief. Adequate well-log control can more easily and clearly define fault or structural traps, as might be expected, than stratigraphic traps. Many examples supporting this statement are available; however, results reported here are confined to the stratigraphic case and in only one geologic horizon.

Results of this exploration tool can

provide varying degrees of information, from partial support to dominant control in regional and local exploration problems. Degree of support available depends upon well control, horizons of interest, and log-evaluation efficiency.

Salinity Trapping

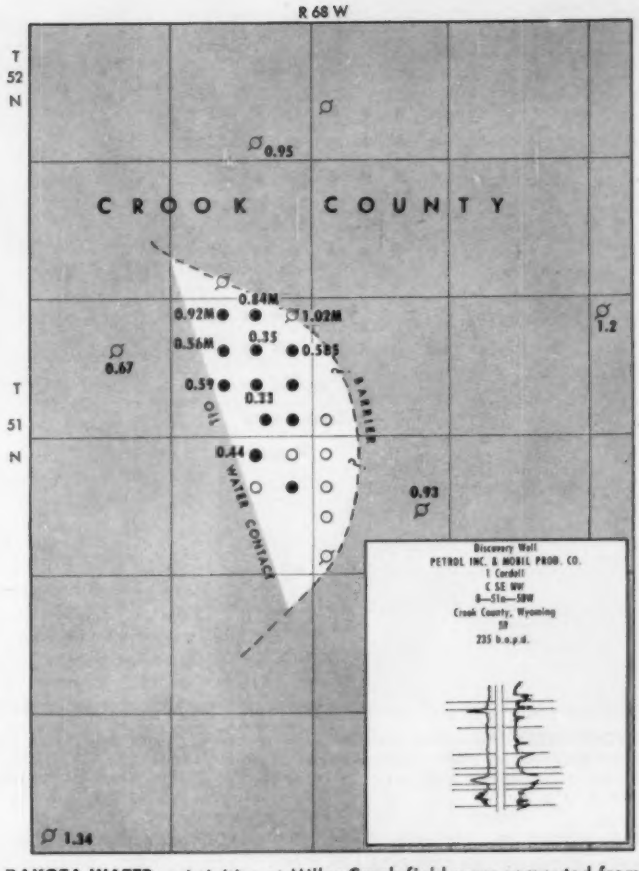
Much work has been done in the evaluation of well logs to determine formation hydrocarbon content, and this item of the two discussed already has general acceptance. Relative salinities, though, are not well understood and are presented for consideration as follows:

Oil-field waters are known to be relatively saline as can be demonstrated by comparison of laboratory water-analyses results. Two maps have been prepared which were taken from contouring done in 1954 by a major oil company. The structure shown in Fig. 1 is productive, and contoured values represent Pennsylvanian sand. A comparison is shown to the approximate mapped subsurface formation closure. Water resistivity values used in this example were obtained from lab-analyzed formation-water samples. A second example (Fig. 2) shows similar work on Pennsylvanian structure which is nonproductive. It is quite obvious that structural traps are well defined by formation-water methods in this Wyoming basin, though the method used in these examples is considered to be inefficient at best.

Electric-log SP curves, read and computed to find water-resistivity values, provide more efficient control when care is taken to read and compute values consistently. Resulting values must be converted to a common temperature for comparison. There are certainly many factors which influence the amount of SP recorded opposite a formation, and the resulting calculated water resistivities. These resistivities correspond only to an assumed equivalent NaCl concentration resistivity. Many formation-water observations in Wyoming wells indicate that the actual formation-water salinity is the dominant controlling factor in amount of SP recorded by logs. Such comment applies to formations which are not too shaly, and that are porous and permeable.

Theory of Salinity Trapping

Results of this work indicate that formations are flushed by groundwater movement and that formation traps, regardless of trap type, are untouched by such flushing. In areas of adequate well density, comparison of water resistivities can establish a mean flush-pattern value of resistivity, and those wells exhibiting values below



DAKOTA WATER resistivities at Miller Creek field were computed from well logs. The "M" values shown are considered maximum because of obvious thinning or shale effects. Fig. 3.

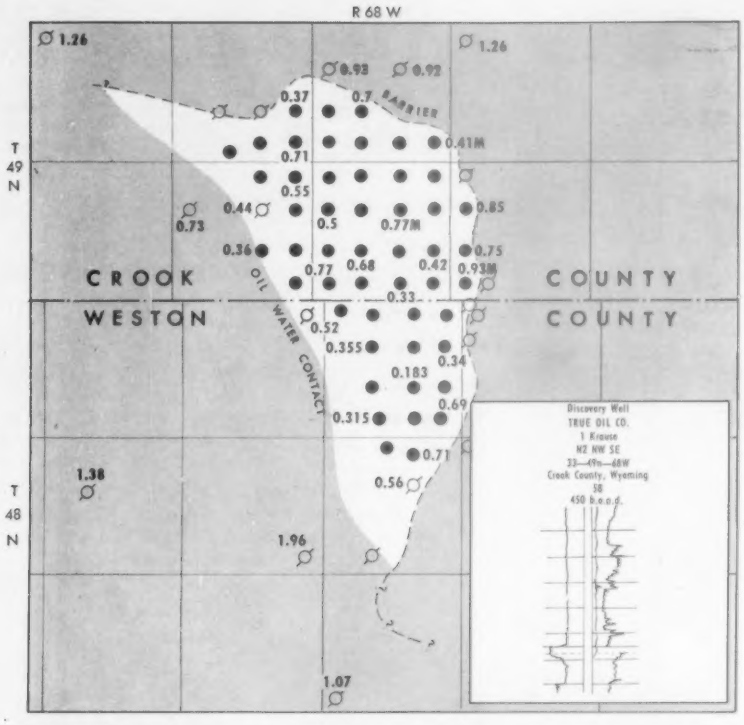
the mean can be assumed to have penetrated some degree of entrapment, whether of stratigraphic, fault, or structural type.

As would be suspected, ontrap and offtrap values are radically different in older marine sediments exposed to fresh-water movements entering outcrops in the near region as in the Figs. 1 and 2 examples of Pennsylvanian age. The differentiation is more difficult to solve in younger formations which are characterized by similar mean pattern values, but which exhibit less saline-trap values. Such variation between average pattern salinity value and trap values has been observed in nearly every producing horizon in Wyoming, and in some nonproductive horizons.

It is pointed out that flushing-water patterns need not originate near known outcrops, but may be present at depth by reason of infiltration of fresh water at ancient outcrops, with such patterns reconforming to each later tectonic change. Support for such speculative thought can be seen in the Green River basin where fresh and saline cycles through Cretaceous and Tertiary formations are drilled with depth. This reasoning was also commented upon by A. L. Evans, Sun Oil Co., Calgary, in his summary of the Canadian Red River formation[1].

Further speculation concerning such flushing patterns of water suggests that a mean or common water movement has been active in any communicative strata through periods of geologic change. Such patterns were and are undoubtedly changing at different rates per region, per time, and have different mean values per horizon. A horizon exposed to fresh-water infiltration at present is observed to be influenced more radically and contains variously more saline mean resistivities with depth, basinward, which situation is commonly observed.

All such theory concerning mean water values supports a conclusion that "original" salinities remain relatively undisturbed within reservoir-trap boundaries. "Original" salinities are in quotation marks here since age, time, and type of deposition (plus trapping type) would control the type of water entrapped; but once trapped, such waters would be influenced only by minor migrational changes within



AT COYOTE CREEK the water resistivities illustrate a larger and more complex stratigraphic situation in the Dakota than at Miller Creek (Fig. 3). Lower water resistivities occur in the trap area as compared to the higher water value surrounding it. Fig. 4.

the trap, remaining relatively stable in salinity. Progressively changing and fresher mean salinity patterns encompass the trap position, laterally, as long as trapping remains effective.

Practical Application for Exploration

Electric logs are indicated to be the only effective data source for exploration using salinity-trapping theories for two reasons:

1. Water analyses per horizon are radically limited and many are in error. By estimate, probably 80% of all Wyoming wildcat drill-stem-test water samples are strongly contaminated with drilling filtrate. These errors vary in degree.

2. Water determinations using electric logs provide nearly 100% input control data, per horizon. Errors, if present in results, are largely of consistent degree, and will not prevent water-pattern determination.

Examination of water resistivities calculated from well logs on and off of oil-productive trapping can demonstrate high resistivities (low, or fresh water salinities) to exist in wells penetrating formations below the water-oil contacts and below formation closure. Furthermore, these values become progressively higher, or fresher, as penetration occurs farther from the trap closure. Two examples (Figs. 3 and 4) illustrate these comparisons in the Dakota formation at Miller Creek and Coyote fields, eastern Powder River basin, Wyoming. It will be seen that values within each field are easily less than 1.0 ohm-meter, whereas dry-hole waters of more than 1.0 ohm occur outside the fields in various directions.

Within the producing traps precise log-evaluation work is required to account for variations of values noted in the examples. Those values followed by "M" denote the value as maximum because of obvious thin-bed or shale effects.

In Fig. 3, Miller Creek exhibits 0.33 and 0.35 water resistivities above the water-oil contact in the producing trap center. In Section 7, 125 ft. structurally lower than production, formation water figure is 0.67. This well, incidentally, was drilled four months before discovery of the field, and this water value is safely below the flushing pattern value in this area.

A dry hole in Section 30, 300 to 350 ft. structurally lower than field center, exhibits a water value of 1.34 ohms. All values are at constant temperature, and fresher flushing waters are assumed to have been much more effective at the Section 30 location than in Section 7.

Water values of 0.93 (E½ of Sec. 16), 1.2 (NW NW of Sec. 11), and 0.95 (in Sec. 32), illustrate other values which are fresher than in-trap figures. It should be mentioned that, before field discovery, the dry holes in Sections 7, 11, and 16 were present. The unusually low water value in Section 7 could have presented a valuable support item of exploration information from logs. Location of the discovery well (SE NW Sec. 8) was based upon other subsurface work. Water from the Section 7 dry hole had been analyzed and found to be unusual in makeup, and the analysis was not correlative with other Dakota trap waters.

Within the field it will be noticed that maximum values are noted at the north edge of Section 8 due to obvious shaliness. This control information was noticed by log work during initial development and allowed placement of an approximate trap boundary before the drilling of dry holes in Sections 5 and 8, which confirmed the barrier.

In Fig. 4, Coyote Creek illustrates a larger and more complex stratigraphic situation in the Dakota sand series. Considerations of lower water resistivities within the trap area and higher water values surrounding the field in flushed pattern control points, however, are even better demonstrated in this case.

Field waters vary from 0.183 to 0.77 in this trap area, some values having been increased by presence of shale and others probably being actually higher by virtue of variation within the various subsidiary stratigraphic traps contained in the entire field. Such variation is of secondary importance.

Before drilling the discovery well in NW SE 33-49n-68w, which exhibits 0.36 water, the following dry holes existed:

Direction from field	Location	Water Values
½ mile north	SW SE 27-49n-68w	0.92
1¼ mile northwest	NW NW 29	1.26
½ mile west	SW NW 33	0.73
1 mile southwest	SE SE 9-48n-68w	1.96

Updip wells to the east are not shown in Fig. 4, but existed before the field discovery and exhibit water resistivities of 1.3 to 2.3 ohm-meters.

As in the case of Miller Creek field, a near miss downdip and west of production (Sec. 33) could have provided salinity-control information, since flushed areas appeared to exist along strike to the northwest in Section 29 and roughly along strike to the southeast in Section 9. As in the Miller Creek key dry hole, water value in this control well is within the trap salinity range.

Subsequent dry holes have further illustrated presence of the flushed fresher water pattern to exist in 8-48n-68w (1.38 water), in 15-48n-68w (1.07 water), in 26-49n-68w (1.26 water), and in 36-49n-68w (1.6 water). Thus the field is surrounded by water resistivities in excess of 1.0 ohm.

Cause of trapping in these two examples of porosity-permeability barriers which are shown in the figures. Position and, indeed, the actual presence of the barriers were not known immediately before oil discovery in each case.

In the normal use of water resistivities for exploration, perhaps no wells have penetrated an obvious porosity barrier, and it is emphasized that such physical support to possible entrapment is not required if sufficient dry-hole control is available. In practice, such complete control is required at this time; but in theory which may soon become practicable, one well control can indicate trap presence as observed in key wells discussed above.

Where wildcats have drilled an obvious porosity barrier and dry holes downdip show porous section, an exploration venture located stratigraphically between the control wells can often be clearly evaluated by log techniques, with recommendations approving or withdrawing support from the venture. In other words, two stratigraphic plays can be identical in respect to dry-hole locations, sand development, porosity indications, and barrier evidence; but near-trap water resistivities plus log-calculated oil shows may characterize one play while fresh waters indicating flushing and no oil shows occur in control wells of the other.

Reference

[1]Rocky Mountain Section, AAPG, Billings, Feb. 8, 1960, "The Red River Formation; A Structural and Stratigraphic Interpretation."

College group studies lower Michigan

A GEOPHYSICAL CREW from Michigan State University has worked most of the lower peninsula this summer. The party from the school's geology department measured gravity and magnetic forces.

The data will be made public after evaluation with anticipation it will help determine oil and mineral deposits in Michigan. The team focused its efforts along an east-west belt in the lower central part of the state. Counties investigated included: Allegan, Ottawa, Barry, Kent, Ionia, Eaton, Clinton, Ingham, Shiawassee, Livingston, Genessee, Oakland, and Lapeer.

According to Dr. William J. Hinze, MSU assistant professor of geology and project leader, Michigan has oil deposits that are untapped but will be hard to find. Factors affecting the difficulty of locating them are due to the great depth of the oil, and the glacial drift overlying these reserves helps hide their existence. Glacial deposits have long plagued explorationists seeking oil.

The work done by the crew is part of a long-range research program. It may take 2 years to compute, analyze, and publish the data obtained this summer. Density of the sedimentary section below the glaciated areas have been taken through gravity readings. The gravity and magnetic data will help give a clearer picture of subsurface conditions.

Assisting Dr. Hinze are graduate students Howard J. Meyer and Joseph J. Mancuso along with undergraduates James F. Carroll, Donald G. Hill, and James E. Lowden. Projects of this type provide excellent data to the state as well as valuable experience for students. A similar seismic program conducted by student members in 1949 of a Rocky Mountain college resulted in the discovery of their state's second largest oil field.

Michigan test raises hopes for area

IN MICHIGAN Sunray Mid-Continent's 2 Berk-Henderson, NE SE SE 32-6n-13e, southwest diagonal offset to the Berlin pool, St. Clair County, discovery, flowed gas and oil at 3,289 ft., probably from A-2 Salina dolomite, and 500 ft. above the completion depths in Niagaran on previous wells. Pay raised new interest in the area after disappointing results on three other offsets.

- C. A. Lee, of Gladewater, Tex., has set a 1959-60 drilling-depth mark on first Michigan venture. Lee's 1 Ferris, C SE NE 5-5n-2e, Shiawassee County, logged Trenton at 5,885 ft. and is drilling ahead at 6,147 ft. It is the first test in more than 2 years to go below the 6,000-ft. mark in the state.
- Rework on James Kelly 1 Dunlop, SE NW SE 22-1s-5w, Lee Township, Calhoun County, completed earlier this year as a Trenton gas discovery, has established Trenton oil pay. Outpost, located a mile northwest of Perry Fulk 1 Ripley oil discovery, tested for 40 bbl. oil per hour after vibra fracturing and 10,000-gal. acid treatment at 4,600 to 4,648 ft. Trenton section logged at 4,230 ft.

Remote wildcat planned in Oregon by Humble

A RIG is being moved into South-Central Oregon for a 12,000-ft. wildcat which has been staked more than 250 miles from the nearest production.

Humble Oil & Refining Co. has been working more than a year to assemble acreage for the wildcat program. The company says it has "several thousand acres" under lease in the Lake County area of Oregon.

The wildcat will be drilled in Section 18-36s-18e. This is about 30 miles north of the California border and 22 miles northwest of Lakeview, Ore. Sun Drilling Co., Los Angeles, has the contract for the well.

The closest production is in northern California about 250 miles from the Humble site.

Operator looking at Knox in Kentucky prospect

In Carter County, eastern Kentucky, Olive Hill Quadrangle, C NE¼ 25-W-77, Jim Procter is drilling at 3,500 ft. at his wildcat, the 1 Burton. This test is now evaluating the Cambro-Ordovician Knox dolomite. Top of the formation has not yet been disclosed.

Dual pay reported at new Southwest Kansas pool

Dual potential is reported in Mississippian and Viola Ordovician rocks at a new discovery in southwestern Kansas' Comanche County. The discovery well is J. M. Huber Corp. 1 Keller in the central part of the county, 4 miles southeast of Coldwater, 8 miles northwest of Beals Lansing-Simpson gas field, and in C NW SE 22-32s-18w.

The well opens production from these zones in Nescatunga field. Calculated open flow was 3,680 M.c.f.d. from perforations in the Mississippian at 5,116-72 ft. Flow from Viola at 5,652 to 5,669 ft. was 4,750 M.c.f.d. plus 289 bbl. of oil per day.

First producer completed for North Dakota's McHenry

First production for McHenry County, North Dakota, was officially opened at California Co. 1 Herdt-Bank of North Dakota in C NE NE 6-158n-80w, 6 miles east of production at Glenburn field, Renville County.

The new pool opener pumped 96 bbl. of oil and 14 bbl. water per day from open hole at 4,201-13 ft. in the Mission Canyon Mississippian.

AFRICA is still in its infancy as far as oil exploration is concerned. Ghana is one of West Africa's highly promising future oil provinces.

Forgotten basin of West Africa:

Ghana's Voltaian basin

BY GEORGE DE MOHRENSCHILDT
Petroleum Geologist and Engineer
Dallas

The writer was commissioned in 1958 by Lehman Trading Corp. of New York to investigate the oil and gas possibilities of Ghana. Lehman Trading Corp. is an international firm with long-time and close connections with West African countries, especially Ghana. This article explains why there is a practically unknown geological basin of some 35,000 square miles in Ghana.

POLITICALLY Ghana is a relatively new country, having gained its independence from England some 5 years ago. As an English possession, Ghana was known as Gold Coast and still appears as such on most maps. The English were mainly interested in mining possibilities of their colony (diamonds, gold) and paid little attention to the large so-called Voltaian basin located in the northern part of the country.

This writer has traveled from one end of Ghana in Accra in the south to the northernmost tip of the country. At Chuchilliga, from the narrow coastal plain dipping rapidly southward into the Gulf of Guinea, the road rises rapidly in northwestwardly direction and goes over granitic and metamorphic outcrops. The country is picturesque, rugged, most of the time heavily wooded, clearings planted with cocoa plants. The main road is excellent.

Soon, north of Kumasi—the capital of Ashanti area—the landscape changes as the Great Voltaian basin is entered, stretching all the way to Bogatonga some 250 miles north. Flat, relatively arid plateau, rising gently in the northerly direction, some cultivated land, few trees, is a typical landscape of the Voltaian basin. Capital of the region is Tamale, a prosperous, modern town of 30,000.

Geology. Water wells drilled in the Voltaian basin covering some 35,000 sq. miles indicate sedimentary beds of alternating clays, sands, and limestones to the depth of 500 ft. Drilling in older Buem deposits (over the border in Togoland) indicates sedimentary beds of alternating shales, conglomerates, sandstones, and quartzites to the depth of some 300 ft.

No deeper drilling was ever attempted to this writer's knowledge in this whole basin. Observations were made of the granites bordering this sedimentary basin and, coming up the stratigraphic column, samples were taken of the Birrimian metamorphic rocks of Devonian age on the road from Walevale to Bolgatonga. They were mainly schists and arkoses and they formed definite hills in contrast to the general flatness of the sedimentary basin. Contacts were very easy to find.

The Voltaian deposits observed in various parts of the basin (the recent cover is relatively thin) can be separated into three main divisions: upper Voltaian (mainly sandstones) of Devonian age; middle and lower Voltaian beds (various sandstones and clays) of undifferentiated Silurian Ordovician age; Basal Voltaian beds are probably of Cambrian age. Upper Voltaian beds are clearly exposed in

"Geologically old basins are highly productive of hydrocarbons in Africa and the Voltaian basin . . ."

Tamale, middle Voltaian on the road from Tamale to Yendi, lower (basal) Voltaian deposits along the edge of the basin near Tongo.

Tectonically, these Voltaian beds are characterized by their general flatness. Not sufficient work was done on occasional dips encountered along the river beds. However, in the northern part of the basin the general dips encountered are of 2-3° south and southeast.

Oil and gas possibilities of the basin. Shows of oil were signaled in the water wells in the very shallow part of the basin near Chuchilliga. Local people lighted lamps from oil collected from a well there. To substantiate these shows, the writer recommended drilling of shallow stratigraphic tests along the edges of the basin. The obvious conclusion as to why such an important basin was left completely intact drillingwise by the British and French geologists is that it is too old a basin to produce. However, the latest discoveries in similar basins in Africa disprove such a conclusion.

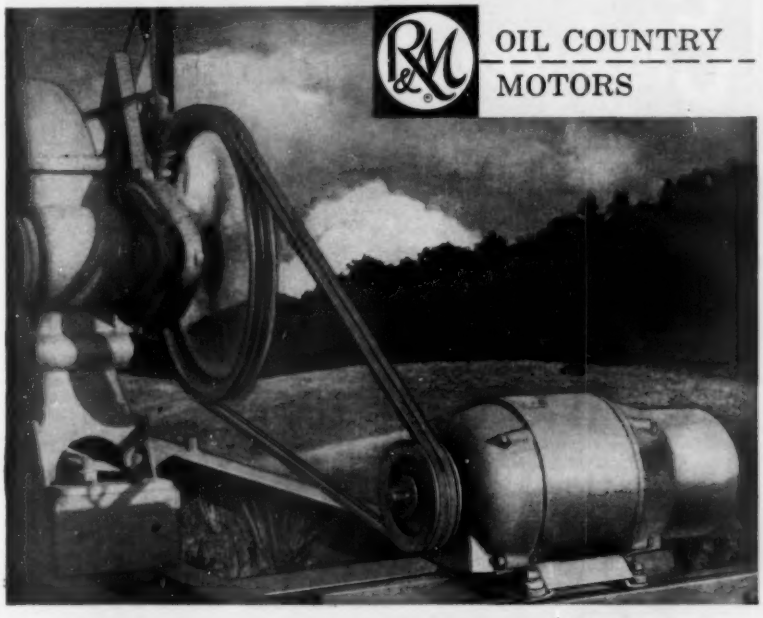
During the writer's stay in Paris when some research was done at the Bureau des Recherches Petroliferes, the following facts came to light: (1) Dry gas was discovered in Sahara from Ordovician deposits (Ahnet and In Salah regions); (2) wet gas is produced from Ordovician beds in Edjele; (3) Gothlandian series of Silurian age yielded shows or organic matter in every region penetrated by a drill in North Africa; (4) Sigenian series of Devonian age were found productive of gas in Ahnet and productive also of high-gravity oil in Erg and Augueur regions; (5) Carboniferous beds are productive of oil and gas in Hassi Messaoud and most of the producing areas of North Africa; (6) Cambrian beds are highly productive of oil and gas in Hassi Massaoud, the largest field in Sahara.

Conclusions. As we can see from the above statements, geologically old basins are highly productive of hydrocarbons in Africa and the Voltaian basin of northern Ghana is an old geological basin and as such should not be disregarded. Africa is still in its infancy as far as oil exploration is concerned, new concepts are rapidly superseding old ones. Some basins generally considered as of continental origin turn out to be of marine origin after a little surface geological investigation and many of them are already productive.

At present surface geological work is being conducted in Ghana which will give further information and give further confirmation as to the marine origin of the beds in Voltaian basin. Also evidence of definite anticlinal structures will be found.

It may be added by this writer that living and working conditions in Ghana turned out to be very pleasant. Both government officials and private individuals (especially tribal chiefs, which is important) are very cooperative. Roads are good. The climate is not worse than some parts of Texas. Minerals belong to the State and an adequate petroleum-exploration agreement was worked out. Terrain in northern Ghana is especially suited for moving either light geophysical equipment or heavy drilling equipment even during the rainy season.

Finally, Ghana—and most newly formed West African countries like Togoland, Dahomey, Ivory Coast, Liberia, and Sierra Leone—are rapidly growing economically and in population. Consumption of petroleum products is increasing very rapidly. Ghana and some other West African countries have sound monetary systems and provide adequate guarantees for foreign investments.



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Australians announce test well for Queensland

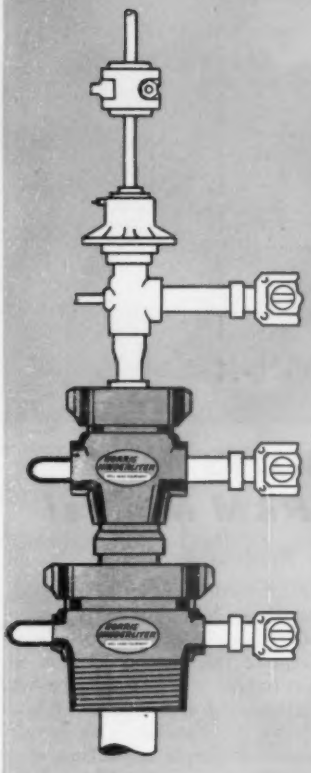
Santos, Ltd., and Delhi Australian Petroleum, Ltd., announce their intention to drill a test well on Mornington Island in the Gulf of Carpentaria, Queensland. Santos and Delhi are joint holders of an authority to prospect in the Gulf. It is planned to commence drilling the latter part of August. The well has a projected depth of 6,000 ft.

A contract has been negotiated with Oil Drilling & Exploration, Ltd., for a drilling rig. The T20 rig now at Beagle Ridge near Perth, western Australia, will be transported by barge around northwestern Australia to the site.

The Minister of Mines, The Honorable E. Evans, welcomed this exploration in the area in question. He said, "This effort by Santos and Delhi in oil search is commended because little exploration at depth has previously been undertaken in the Gulf."

The Carpentaria basin holds interest in that, although largely untested, it is an extension of the Great Australian artesian basin. There is potentially deepening sedimentation seaward and Mornington Island is thought to be ideally suited to check the section for oil in this extensive area. A particular interest lies in the possibilities of a Paleozoic succession at depth.

Engineered Simplicity



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Exploratory test slated for Alberta's Beiseker

In Canada Canpet Exploration, Ltd., and its partner, L-M Oil Company, Ltd., reported the location for an exploratory test will be taken down on Canadian Pacific Oil & Gas, Ltd., freehold rights in the Beiseker district of southern Alberta. It is situated 30 miles northeast of Calgary, 15 miles southwest of gas production in the Carbon field and 2 miles northwest of the Canadian Western Natural Gas Carbon-to-Calgary pipeline system.

Lake Erie offshore well has gas flow

In Canada, Place Gas & Oil Co., Ltd., reports that Place 20 Walpole gas well offshore Lake Erie near Selkirk, Ont., has obtained an open gas flow of approximately 1,100 M.c.f.d. of gas.

Of great significance in this latest well was the flow of gas from both the Red Medina and Thorold formations with total effective pay zones of 31 ft. This is the third successive successful gas well drilled this year by Place on its acreage in the eastern sector of Lake Erie.

In the Port Dover and Walpole areas, Place now has a total of 15 commercial gas wells of which 12 are on stream to an extensive gathering system, while the first and second wells drilled this year are currently being connected to the gathering system. This pipeline system ties in to the retail outlet of Union Gas Co. on shore. The current market price paid to Place is 45 cents per thousand cubic feet. The Place 20 Walpole well is located 1 mile south of Walpole No. 8.

In the western sector, offshore from the important Colchester oil field the Place 4 Colchester well is currently drilling at 1,600 ft. Place 1 Colchester which was drilled last year is now on production as the tank battery facilities have been completed.

Southeast Kansas field is being confirmed

The confirmation well to Kinsler field in Morton County, southwestern Kansas, is apparently a success. Pan American Petroleum Corp. is testing at 1 Sharp, 1¼ miles northwest of the discovery well.

The 1 Sharp, C NW SE 29-31s-40w, has pipe set at 5,554 ft. Kinsler field was tapped last fall at 1 Kinsler in NW NW SE 33. That well flowed 4 M.M.c.f.d. from Marmaton Pennsylvanian at 4,335-39 ft. and 15 M.M.c.f.d. from St. Louis at 5,465-67 ft., a Mississippian pay.

New Devonian oil pool opens in New Mexico

Southeast New Mexico's newest important Devonian oil discovery is Ohio Oil Co. 1 Lea Unit, southwestern Lea County, 15 miles southwest of Monument.

Ohio completed the flowing Devonian well for 170 bbl. of 53.9°-gravity oil through 8/64-in. choke from deep perforations at 14,347-75 and 14,393-89 ft. This new-pool opener is located in 12-20s-34e, 2½ miles southwest of shallow Pearl field.

Abo country. Carper Drilling Co. 2-B Fee-MA, an east offset to the 1 Federal-MA Abo reef discovery well, was completed as the confirmation and second producer to this new area in Lea County's 31-17s-33e, 12 miles southeast of Maljamar.

The well flowed 480 bbl. of 37.3°-gravity oil daily through 16/64-in. choke from perforations at 8,654-92 ft. in the Abo.

Flowing Devonian production reported in New Mexico

Lea County in southeastern New Mexico has a flowing Devonian oil discovery at Max Pray 1 Z. L. Craig in NE SW 27-12s-37e.

The well flowed 432 bbl. of oil per day on 9/64-in. choke from perforations at 12,304-ft. Nearest Devonian oil is at Gladiola field.

Two Queen sand wells flow gas in New Mexico

Lea County, Southeast New Mexico, has two good Queen-sand gas producers. The Aztec Oil & Gas Co. 1-AJ State, SW SW 1-18s-36e, completed for 20 M.M.c.f.d., absolute open flow. Production is from 4,452-66 ft. Cactus Drilling Co. completed 1-B Catron State for 825 M.c.f.d. Both wells are in little-drilled and sparsely productive areas of Lea County.

Sun Oil Co. Sun Oil Co. 1 Elizabeth Watson in NW SE 9-9s-34e, northeastern Lea County, flowed 106 bbl. of oil per day on tests of an unidentified formation at 9,714-40 ft.

This well is 1 mile southwest of Sun's 1 McNulty Pennsylvanian discovery, a 207-bbl. strike.

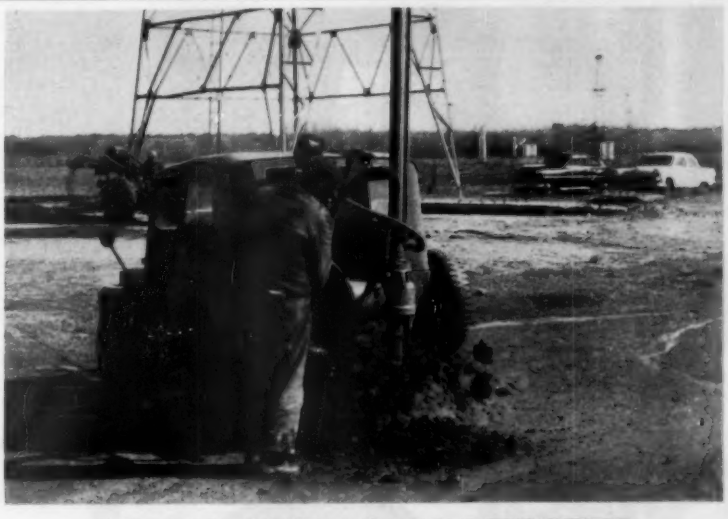
New Gallup pool opens in San Juan basin

New Mexico's San Juan basin has another Gallup Cretaceous oil area. El Paso Natural Gas Products Co. completed 2 Ojo Amarillo, confirmation well to its 1 Ojo Amarillo, as a Gallup producer for 231 bbl. per day from perforations at 5,230-46 ft.

This new producer is in NE NW 27-29n-14w. Work is now going on with two field wells working. The 3 and 4 Ojo Amarillo will help define this new area where there has been little previous drilling activity or production.

Dakota gas. A Dakota Cretaceous gas discovery was completed by Aztec Oil & Gas Co. at 11-D Hanks in NW SW 7-27n-9w. The well flowed 3,554 M.c.f.d. from perforations at 6,510-6,734 ft.

About 11 miles north, the 12-D



60 OIL WELLS PROTECTED FROM CASING CORROSION

A major company operates 60 oil wells in a field in Coke County, West Texas. When external casing corrosion became a problem, it was decided to protect 35 of the wells cathodically. CSI was given engineering and turn-key installation contracts on a competitive bid basis.

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Hanks in SE NE 7-29n-9w, a 7,200-ft. Dakota test, is drilling ahead. The 7 Richardson in NW SE 15-31n-12w is drilling at 630 ft. The 7 spots 1 mile northwest of the 6 Richardson, a dual gas completion. That well had both Dakota and Mesaverde production. Location is in NE SE 22-31n-12w. The 6 flowed 5,956 M.c.f.d. from Dakota and Mesaverde combined.

Escrito. In the Escrito area of Southwestern Rio Arriba County, T. H. McElvain completed 1-A Miller as a dual gas discovery. The well flowed 3,345 M.c.f.d. from Gallup and Dakota. Location is in NE NE 13-24n-7w.

Kingfisher activity strong in Oklahoma

Drilling activity continues to hum in Oklahoma's Kingfisher County. Jones and Pellow Oil Co. 1 Crossley in C NE NW 4-18n-7w, North Dover field, flowed 100 bbl. of oil in 10 hours through ¼-in. choke from Manning Mississippian perforations at 6,909-20 ft. and 6,929-41 ft. The Oswego at 6,504-20 ft. was good for 38 bbl. of oil in 8 hours through 24/64-in. choke.

At East Hennessey field, the 2-B Schimanek in C NE NW 15-19n-6w flowed 32 bbl. of oil in 4 hours during tests. Previously in the Meramec at 6,755-70 ft., the well flowed 220 bbl. of oil in 10 hours through 18/64-in. choke.

North Hennessey. Carter Division of Humble Oil & Refining Co. 1 Huntsberger, C NW SW 11-19n-7w, is the second producer and a new-pay discovery for this field. The well flowed 17 bbl. condensate in 6 hours from Mississippian at 6,997 to 7,174 ft. and 44 M.M.c.f.d. from the same zone. The Manning was good for 18 bbl. condensate daily and 2,940 M.c.f.d., open flow, Manning being a new pay for the field.

Oklahoma's Southeast Marietta has new pay

The McLish Ordovician sand is a new pay for Southeast Marietta field in Love County, southern Oklahoma.

Samedan Oil Co. 1 Continental-Westheimer, SE SW NW 19-7s-3e, flowed 633 bbl. of 40°-gravity oil per day from perforations at 11,778-11,948 ft. This opens a new producing zone for the Oil Creek sand producing area.

Second producer added to Northwest Oklahoma field

The 1 Herald is a new and second well for East Orienta field in Major County, northwestern Oklahoma.

The Anderson-Prichard Oil Corp. dual completion in C SW NW 29-22n-11w, flowed 92 bbl. of oil in 16 hours on ½-in. choke from Manning Mississippian at 6,830-82 ft.; 8,575 M.c.f.d. and 10 bbl. condensate on 4-hour test in the Mississippian lime at 7,105-19 ft.

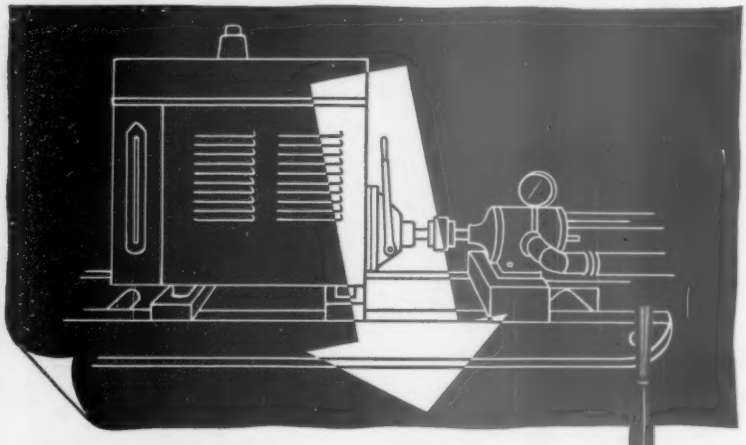
Ohio pool in Perry County is confirmed

In Ohio, the first completed offset confirming a new pool discovery in southwest Pike Township, Perry County, has been reported by Preston Oil Co.

Preston's 1 J. V. Boley, Section 30, tested 3,500 M.c.f.d. with 2 bbl. of oil, 10 days after fracture. The Clinton sand was found at 3,297-3,329 ft. and had a natural gage of 363 M.c.f.d. with a show of oil. Initial rock pressure was 1,205 psi.

Other activity in Perry County includes another success by Mid East Oil Co. in the Clayton pool in southeast Madison Township.

The 2 Friel Realty Co., Section 27, made 130 bbl. of oil with 265 M.c.f.d. in a 24-hour test 3 weeks after fracture. Natural production from the Clinton sand at 3,360-3,417 ft. was 2 bbl. of oil with a showing of gas.



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Field rules asked for new Montana discovery

Application was filed with the Oil and Gas Conservation Commission in Montana for 80-acre spacing for a new field opened by Sumatra Oil Co. in Montana's Musselshell County.

The discovery well flowed 277 bbl. of oil daily from ¼-in. choke from Tyler at 4,594-4,604 ft. Location is 3 miles southwest of Ivanhoe field. Sumatra wants the field to be called Keg Coulee. Area is SW 25, S½ 26, all 35 and 36-11n-30e, all 1 and 2-10n-30e.

Dual-zone gas find for Wind River

WIND RIVER BASIN apparently has a two-zone gas discovery at Shell Oil Co. 14-12 Unit in the Pavillion area of Fremont County, 13 miles east of Pilot Butte oil field.

Gas flowed on drill-stem tests of both the Wind River and Fort Union Tertiary zones. Flow was 1,880 M.c.f.d. on test of the Wind River at 3,299-3,370 ft. The Fort Union at 3,841-98 ft. got 1,730 M.c.f.d. Drilling is now below 4,329 ft. on its way to 6,500 ft., depth objective. Tops are not reported at the well as yet.

This is the second Wind River basin discovery for Shell in the past few weeks. Shell recently shut in a Lance Upper Cretaceous gas discovery at 23-15 Howard Ranch Unit in NE SW 15 - 39n - 93w, Fremont County, 30 miles east of the Pavillion wildcat.

Colorado's West Douglas Creek gets gasser in Emery

Emery gas production was opened in a Rio Blanco County wildcat in northwestern Colorado. The discovery well is Beardmore Drilling Co. 18-3 Government in SW SE 18-2s-102w, West Douglas Creek area.

This new gasser flowed 2,100 M.c.f.d. from open hole at 2,630-2,908 ft. Location is about 1 mile northeast of nearest production in West Douglas Creek field.

Denver basin adds new Dakota "J" sand producer

In Nebraska's portion of the Denver basin in Morrill County, currently the basin's hottest drilling arena, British-American Oil Producing Co. completed 1 Nebraska-H in C NE SW 16-17n-52w.

The well pumped 262 bbl. of oil daily from perforations in the Dakota Cretaceous "J" sand at 5,230-34 ft. Location of this new pool-opener is 1 mile northwest of the one-well Baumgartner field.

New test may be Texas' deepest

TESTING continues in the Devonian at what promises to be Texas' deepest producer. Atlantic Refining Co. 1 J. C. Kelly, multipay gas prospect in Pecos County's western area, 31 miles west of Fort Stockton, tested 16,100 M.c.f.d. on ½-in. choke from perforations in the Devonian from 15,927-82 ft. and 15,831-15,908 ft.

Earlier tests in the Montoya's upper zone at 16,228-16,402 ft. flowed 14,511 M.c.f.d. From perforations at 16,550-16,680 ft. in another Montoya zone the well made 4,786 M.c.f.d., making it the deepest production in Texas. The Fusselman zone from 16,061-16,170 ft. was good for 10,846 M.c.f.d. through ½-in. choke. Location is in a remote oil-gas barren area in Section 8, Block 51, T-10, T&P Survey.

Wolfcamp oil flows at West Texas prospect

Wolfcamp Permian oil production is apparent at a wildcat in Martin County, West Texas. The indicated discovery is Jake L. Hamon 1 W. M. Yates, a 12,500-ft. objective in Breed-

In the field, Roper Series 3600 Pumps are used for such applications as circulating and recirculating, pulling from test tanks, and for general transfer work.

Widely recognized for dependability, Roper Series 3600 Pumps are designed to handle thick or thin oil at slow speeds. Available in 40 to 300 GPM sizes, pressures to 100 PSI, they are fitted with two equal size helical pumping gears, heavy duty, high-lead bronze bearings, adjustable relief valve; with packed box or mechanical seal. Specify Roper . . . job-proved in oil fields everywhere!

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love field, 6 miles southwest of Patricia.

The well is drilling ahead below 10,227 ft. after flowing oil on a drillstem test at 9,957-10,083 ft., opening a new pay for the area. The well flowed 43 bbl. of oil in 2½ hours through 1-in. choke. Location is in Labor 21, League 263, Kent CSL Survey.

Northern California gas discovery is confirmed

THREE MORE WELLS are planned in California's most northernly drilling play—a gas search being conducted in Humboldt.

Zephyr Oil Co. of Long Beach has confirmed its recently Humboldt County discovery by completing the Leon Oro Blanco T-2 as a 4,000,000 cu. ft. a day gas well. The T-2 is about 2,000 ft. west of discovery well.

The confirmation well was perforated in four zones between 3,900 and 4,800 ft. The 4,000,000-cu. ft. flow was through a ¼-in. choke. The well was drilled to a total depth of 4,926 ft. The discovery flowed 800,000 cu. ft. daily through a 3/16-in. choke from perforations between 4,800-10 ft. after deeper shows proved noncommercial (OGJ, June 13, p. 185).

LOGGING PAPERS AVAILABLE

The complete set of papers presented at the S.P.W.L.A. Logging Symposium in Tulsa, Oklahoma, May 1960, are now available. Price is $5.00 per set, postage paid in United States. Address orders to:

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The set is composed of the following:

A REVIEW OF FUNDAMENTAL NUCLEAR PHYSICS APPLIED TO GAMMA RAY SPECTRAL LOGGING, J. D. Owen, Phillips
APPLICATIONS OF THE PROXIMITY LOG, R. G. Hamilton, Consultant
A METHOD FOR DETERMINING FORMATION PERMEABILITY FROM WELL LOG DATA, J. P. Johnson, Kewanee
FIELD EXAMPLES OF NUCLEAR MAGNETISM LOGGING, Paul Hull, Standard of Texas and J. E. Coolidge, Byron Jackson
EXPLORING FOR PETROLEUM TRAPS USING ROCKY MOUNTAIN ELECTRIC LOG EVALUATION, Bob Jones, Consultant
INTERPRETATION OF DIPMETER SURVEYS IN MISSISSIPPPI, J. A. Gilreath, Schlumberger
RESISTIVITY-VELOCITY LOG EVALUATION OF THE MORROW SAND IN WESTERN OKLAHOMA, F. S. Millard, Humble (Carter Division)
SOME PETROPHYSICAL ASPECTS OF THE MISSISSIPPIAN "CHAT" GLICK FIELD, KIOWA COUNTY, KANSAS, J. D. Duren, Shell
APPLICATION OF FLOWING WELL LOGGING OPERATIONS TO PRODUCTION PROBLEMS, H. L. Bryant, Jersey Production Research
ACCURACY OF POROSITY DETERMINATIONS, R. E. Jenkins, Core Lab., Inc.
A METHOD OF OFF LOCATION QUANTITATIVE MUD ANALYSIS FOR HYDROCARBONS, W. H. Russell, Baroid
LOG ANALYSTS ARE IMPORTANT PEOPLE, M. W. Haas, Humble (Carter Division)

Wyoming's Arch Unit gains fourth Almond oil well

The fourth Almond Cretaceous sand oil well on Wyoming's Arch Unit in Sweetwater County flowed 712 bbl. of oil per day. The well is Forest Oil Corp.-Union Pacific Railroad Co. 5 Arch 19-3 in NW NW 19-19n-98w.

This Green River basin well is the northernmost producer in the Patrick Draw field area. There are two locations by this team farther north at 6 Arch in C SE SE 13-19n-99w, and 7 Arch in C NW SW 18-19n-98w.

Discovery wells

ARKANSAS

Franklin County:
Arkansas Western Gas Co. 1 H. Weiderkehr, 10-9n-26w, ½ mile north of Altus. IP 1,500 M.c.f.d., calculated open-flow potential, dry gas, shut-in pressure 1,311 psi., perf. 4,875-95 ft. and 5,037-57 ft., basal Atoka and lower Cannon sand, and 13 M.M.c.f.d., calculated open-flow potential, dry gas, shut-in pressure 2,001 psi., perf. 5,242-56 ft., Hale sand. TD 5,390 ft. Discovery well of Altus field.

CALIFORNIA

Fresno County:
Leda Petroleum Co., Guijarral Service Co. 24X-22F, SW NW NW, 22-20s-16e, 25 B/D, 35° gravity, 1-in. choke, perf. 8,345-71 ft., 5½-in. casing to 8,379 ft. TD 8,380 ft. (New pool discovery ½ mile northeast of Guijarral Hill production.)

Glenn County:
Humble Oil & Refining Co., John R. Hulen et al. 1, NE SW SW 23-18n-1w, 2,350 M.c.f.d., 22/64-in. choke, perforations at 2,383-96 ft., 7-in. casing to 3,902 ft. TD 7,019 ft. (New-field discovery about 3½ miles south of Afton gas field and 4½ miles northeast of Priceton gas field.)

Solano County:
Amerada Petroleum Co., W. E. Rayn Gas Unit 1, SW SW SW, 18-6n-2e, 7,300 M.c.f.d., ⅜-in. choke, perf. 6,798-6,810 ft., 6,818-30 ft., and 6,835-50 ft. TD 7,654 ft. (Well is 1 mile northwest of Maine Prairie Gas Unit A 1 discovery completed June 4, 1960, by G. E. Kadane & Sons.)

MISSISSIPPI

Amite County:
Larco Drilling Co. 1 15-43 USA, NE NW SW NW 15-4n-3e. IP 246 BOPD, ¼-in., 22.1°, TP 200 psi., GOR 184 cu. ft. per bbl., perf. 10,458-66 ft., upper Tuscaloosa. TD 11,524 ft.

TEXAS GULF COAST

DeWitt County:
Monsanto Chemical Co. 1 Walter Feller, L. V. Criswell Sur., A-116. IP 1,513 M.c.f.d., 10/64-in., GLR 31.6 bbl. per M.M.c.f., 53°, TP 2,418 psi., perf. 9,524-38 ft., Wilcox. TD 10,715 ft. New-field discovery in Yorktown area.
Lone Star Producing Co. 1 Felix Hiller, William Dearduff Sur., A-163, 3 miles southeast of Cuerco. AOF 4,200 M.c.f.d., perf. 9,997-10,014 ft., Wilcox. TD 14,474 ft. Second well, new pay, and extension in unnamed newly discovered field.

Galveston County:
Roy M. Huffington, Inc., 8 State Tract 3, John Sellers Sur., A-180, 6 miles east of Dickinson. IP 188 BOPD, 12/64-in., 36.1°, GOR 692 cu. ft. per bbl., TP 675 psi., perf. 9,600-10 ft., Frio, and 144.75 BOPD, 12/64-in., 35.6°, GOR 624 cu. ft. per bbl., TP 490 psi., perf. 9,576-84 ft., Frio. TD 9,887 ft. New pays in Dickinson field.

Goliad County:
Harkins & Co. 1 R. J. Ressman, Peter B. Dexter Sur., A-319, 4 miles southeast of Weewatchie. IPP 12 BOPD, 45°, perf. 5,297-5,301 ft., Yegua. TD 9,015 ft. New-field discovery.

Jackson County:
Texaco Inc. 4 J. F. Weed, John D. Newell Sur., A-61, 3 miles south of Francitas. IP 178 BOPD, adjustable choke, 42.8°, GOR 4,950 cu. ft. per bbl., TP 2,727 psi., perf. 8,960-70 ft., Frio. TD 9,312 ft. New oil reservoir in Francitas gas area.

Karnes County:
H. T. Bryant Drilling Co. and Glen A. Martin 1-B W. P. Belknap, C. Hynes Sur., 11 miles south of Runge. IP 74 BOPD, 6/64-in., 41.9°, GOR 820 cu. ft. per bbl., TP 875 psi., perf. 7,827-31 ft., Wilcox. TD 7,965 ft. New-field discovery.

Lavaca County:
Crescent Carbon Corp. 3 M. C. Oldham, William K. Paulding Sur., A-368, 15 miles west of Garwood. AOF 1,250 M.c.f.d., dry gas, shut-in TP 1,037 psi., perf. 3,503-05 ft. TD 3,879 ft. New pay in West Garwood area.

Matagorda County:
U. M. Harrison 1 D. P. Moore Estate Unit, Block 47, Moores Park Addition, R. P. T. Stone Sur., A-92, inside city limits of Bay City. IP 203 BOPD, 12/64-in., 31.5°, GOR 808 cu. ft. per bbl., TP 3,550 psi., perf. 10,221-27 ft., Frio., and AOF 14,400 M.c.f.d., GLR 330 M.c.f. per bbl., 46.7°, shut-in pressure 3,622 psi., perf. 10,334-40 ft., Frio. TD 10,505 ft. New-field discovery.

SOUTHWEST TEXAS

Brooks County:
Coastal States Gas Producing Co. 1 Carmelia Adair, Section 6, Falfurrias Farm & Garden Tracts, Los Olmos Y Loma Blanca Grant, 1 mile west of Falfurrias. AOF 13,500 M.c.f.d., GLR 50 M.c.f. per bbl., 54.6°, shut-in TP 3,442 psi., perf. 7,846-68 ft., Frio. TD 8,712 ft. Discovery well of West Falfurrias field.

Duval County:
Sun Oil Co. 1 L. G. de Leal, Share 7, La Huerta Grant, A-227, 25 miles south of San Diego. AOF 230 M.c.f.d., dry gas, shut-in TO 884 psi., perf. 2,269-75 ft., Miocene. TD 5,505 ft. New-field discovery—2 miles southwest of Sana Cruz field.

LEGAL

SALE OF OIL AND GAS MINING LEASES, Department of the Interior, Bureau of Indian Affairs, Jicarilla Indian Agency, Dulce, New Mexico. Sealed bids will be received until 3:00 P.M., Mountain Standard Time, July 27, 1960, and then opened at that time in the office of the Jicarilla Indian Agency, Dulce, New Mexico, for the leasing of 37,262 acres of Tribal Indian land located in Rio Arriba County, New Mexico, within the Jicarilla Indian Reservation, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of the Jicarilla Indian Agency, Dulce, New Mexico.

Tough Oil Jobs Are Not New

. . . for Sun Oil's Dick Anderson. His 22-year career is proof that hard work is unbeatable as a success formula.

THE career of Richard R. Anderson, Sun Oil Co.'s new director of production for the U. S. and Canada, proves once again that hard work, enthusiasm, and the ability to get along with people are valuable ingredients of success.

Anderson has spent all his career with Sun in the same department, completing his 22nd year on July 1. He went to work in 1938, immediately after graduation from Cornell, as a roustabout and pumper in Evansville, Ind. His subsequent rise to director of production in Sun's Philadelphia headquarters is a study in application.

Here's what one associate had to say of him: "Dick constantly reads publications and other material on the oil and gas industry to keep himself up to date on new developments in operating techniques and drilling.

"His time is always the company's time. He is always ready to give extra time and effort to get a job done—and always displays zest, enthusiasm and drive in getting it done."

Richard R. Anderson

. . . a study in application.

Good leader . . . In addition to his enthusiasm, Anderson has another fine attribute—his ability to get along with people.

One of his superiors attributed Anderson's success "to his ability to get along well with subordinates and to obtain from them the best work they are capable of doing.

"He has shown an exceptional ability to gain the respect and loyalty of his associates," this man continued, "and has a reputation for absolute fairness in all his dealings with others."

That superior had one other significant comment: "Anderson has consistently shown the ability to act decisively in difficult situations. Furthermore, he learns from experience and never has made the same mistake twice."

There was an oily influence in Anderson's early life that may have directed him to petroleum. His father, Dr. Ross P. Anderson, was director of the API Division of Refining for many years.

Dick Anderson was born in Ithaca, N. Y., Dec. 29, 1916, while his father was a member of the chemistry faculty at Cornell. He finished high school in Pelham Manor, N. Y., and then went to Cornell where he got a bachelor's degree in economics. He later took a course in petroleum engineering. He was a good student and an athlete in his college days, rowing as a member of the jayvee crew.

Busy days . . . Anderson stayed in Sun's Central Production Division from 1938 to 1951.

He advanced progressively from roustabout to gang pusher to foreman and to district superintendent. In 1951 he was made assistant manager of the land department in what was then Sun's Michigan production division with headquarters in Toledo, O.

One year later he was transferred to Louisiana where he remained until he moved to Philadelphia in 1957. His first job was that of a landman in the Gulf Coast production division at Lafayette. In 1953 he became assistant regional superintendent. He remained in Lafayette in that capacity until he was moved to the general office in Philadelphia as administrative assistant to the production vice president.

Anderson believes in good public relations for oil and practices what he preaches. While still in Lafayette he was general chairman of the Louisiana Gulf Coast Oil Exposition and was area chairman for the Oil Information Committee. He worked at the job as area chairman and in 1955 won the OIC Silver award and, 2 years later, its Gold award.

He has been active in Boy Scout work and is an elder in the Presbyterian church. He is a member of the Mid-Continent Oil & Gas Association and the American Petroleum Institute.

Anderson and Miss Margaret R. Koch of Pelham Manor were married in 1940. They reside in Rosemont, Pa., with their three sons, Richard, 19; Robert, 17, and John-Eric, 15.

▶▶▶ Personals

Edward L. Steiniger, president of Sinclair Oil Corp., has been elected chairman of Fordham University's board of lay trustees. Steiniger was named to the board when it was formed last year.

William E. Lifson, assistant director in Esso Research & Engineering Co.'s products research division, will take over administrative duties of **Dr. Leonard E. Moody,** associate director of the division, during Moody's one-year rotational assignment with Humble Oil & Refining Co. in Houston.

Dave Pasta, geologist with Texaco Inc., has been transferred to Ventura, Calif., from Los Angeles.

Martin L. Courter has been named process development manager in Shell Chemical Co.'s industrial chemicals division. He will headquarter in New York. Courter had been supervisor in the chemical process engineering department of Shell Development Co.'s Emeryville, Calif., research center.

W. D. Allison has been promoted to senior supervising engineer in the technical division of Humble Oil & Refining Co.'s Humble division, Baytown, Tex.

R. W. Burchell has been appointed senior research engineer in California Research Corp.'s Richmond, Calif., laboratory. **Dr. A. D. Abbott** and **Dr. D. W. Criddle** have been named senior research chemists in Richmond. **Dr. J. D. Knight** has been named technical assistant to the manager of the chemicals research division, Richmond.

▶▶▶ Personals

Albert Wright, assistant producing coordinator for Standard-Vacuum Oil Co., has moved up to producing coordinator. He succeeds **Harry A. Gibbon,** who has retired after 35 years with Stanvac and its affiliates. Wright joined Stanvac in 1938 as chief petroleum engineer and assistant producing superintendent of its Indonesian producing and refining subsidiary. He was coordinator of Indonesian affairs before being named assistant producing coordinator in 1956.

WRIGHT

F. R. Palin, assistant general manager, secretary, and treasurer of Union Gas Co. of Canada, Ltd., and Ontario Natural Gas Storage Co., has been promoted to general manager. He succeeds **Thomas Weir,** vice president and general manager, who has retired. Weir will continue as a director. Palin will continue as treasurer but will be succeeded as secretary by **J. W. S. McOuat.**

W. S. Gibson, district engineer for Interprovincial Pipe Line Co. in Regina, has been named superintendent of the Sarnia, Ont., district. He succeeds **J. E. Letson,** who will be superintendent of the Regina district. **O. T. Linton,** superintendent in Regina, will be transferred to Toronto as management assistant in the executive offices of the company there. **A. B. Jones,** formerly management assistant in Toronto, has been named coordinator, planning and economics department, in Edmonton, succeeding **P. H. Buckland.** Buckland has been named assistant district superintendent in Bay City, Mich., for Lakehead Pipe Line Co., Inc. Lakehead is the U. S. section of Interprovincial.

Dr. Andrew Dravnieks has been named scientific advisor in chemistry research for Armour Research Foundation. He was head of the corrosion section of Standard Oil Co. (Ind.) before joining the foundation.

Al Cashman and **Joseph E. Morero,** vice presidents of Skelly Oil Co., have been promoted to senior vice presidents. **Paul A. Tanner,** general manager of marketing, has been elected vice president, marketing. **Hawley C. Kerr,** supervisor of the legal department, has been named general counsel.

Walter B. Gilbert, assistant Denver division sales manager for Texaco Inc., has been promoted to division sales manager. He succeeds **Wallace A. Strimple,** who has retired.

Warren C. Johnson, manager of the southern division of Standard Oil Co. of California in Whittier, Calif., has been named president of Lomita Gasoline Co., a subsidiary. He succeeds **L. V. Cassaday,** who has retired. **M. S. Hubbell,** Lomita secretary-treasurer and superintendent of the company's Signal Hill, Calif., natural-gasoline plant, has been named manager of Lomita.

J. J. Maurer, Jr., manager of refineries for Delhi-Taylor Oil Corp., has been named manager of the manufacturing division and transferred from the Corpus Christi, Tex., refinery to general offices in Dallas. **Lewis Gross,** chief engineer of manufacturing in Corpus Christi, has been named manager of research and development in Dallas. Also moving from the Corpus Christi plant to Dallas will be **Frank A. Reneau,** director of safety and training; **George Owsley,** manager of distribution for the chemical division; and **T. A. Wooters,** manager of crude-oil and LPG sales, marketing division. **Harry Warnke,** plant superintendent in Corpus Christi, has been appointed plant manager there. **I. L. Doty,** McAllen, Tex., has moved to Corpus Christi as terminal superintendent.

Dr. George W. Ayers has been named senior research associate in Pure Oil Co.'s Crystal Lake, Ill., research center. **Glenn A. Marsh** has been named research associate and **Dr. J. M. Parks, Jr.,** has been named senior research scientist there. The appointments are part of Pure's new system of progression and titles recognizing scientists and technical specialists in nonadministrative positions. In other appointments under the system, new research scientists are **Dr. G. D. Brunton, Dr. G. W. Crosby, W. L. Fierce, Dr. D. L. Klass,** and **Dr. Walter E. Kramer.** Technical specialists are **Dr. R. T. Bell, Kenneth Boldt,** and **C. A. Porter.** Senior technologists are **W. G. Annable, G. W. Simmons,** and **Dr. B. B. Woertz.** Technologists are **W. J. Alford, W. T. Berg, Dr. H. A. Lindahl, F. L. Mueller, P. E. Pfeiffer, Jr.,** and **D. G. Samuelson.** The title section supervisor has been given to **E. W. Brennan, Dr. H. O. Folkins, H. Hennig, L. W. Holm, A. Manteuffel, Dr. Carel Otte, Dr. H. A. Slack,** and **Dr. K. P. Yates.** Group supervisors are **A. J. Ackerman, Dr. J. M. Fraser, R. G. Moyer,** and **A. W. Percy.**

Kenneth A. Harlan, geologist with Humble Oil & Refining Co., has been transferred to New Orleans from Laurel, Miss.

Joseph M. Jerome, manager of Tidewater Oil Co.'s New England marketing district, has been appointed New York marketing district manager. He succeeds **A. Senecal,** who recently resigned. **Thomas A. Differ** will succeed Jerome.

Robert H. Scholl, executive vice president of Humble Oil & Refining Co.'s Esso Standard division, has been named director of public relations for Standard Oil Co. (N. J.), the parent company. **Stewart Schackne,** public relations department manager for Jersey Standard, has been named public relations counselor.

Robert E. Roehl, former assistant to the manager of transportation and supply for Cities Service Co., has been named coordinator of foreign supply and transportation activities for Cities Service International, Inc. **Charles T. Klein,** manager of the natural-gas division and a director of Cities Service Oil Co., has been elected vice president and a director of Cities Service Gas Co., a new position. Klein will move to Oklahoma City from Bartlesville, Okla. Roehl has returned to Cities Service after a year's leave of absence to serve as coordinator of transportation for the Interior Department's Oil and Gas Division.

ROEHL

KLEIN

I. E. Levine, manager of the chemicals research division of California Research Corp.'s Richmond, Calif., laboratory, has been elected vice president of Cal Research in charge of the chemicals research department. He succeeds **J. Q. Cope,** who recently was transferred to California Chemical Co. **H. M. Lavender,** manager of the process and engineering division in Richmond, will succeed Levine there. **J. F. Senger,** senior coordinator of process design and engineering in San Francisco, has been transferred to Richmond as manager, process and engineering division. **E. B. Chiswell,** California Chemical Co., will succeed Senger in San Francisco.

Jack R. Mills, formerly with Sunray Mid-Continent Oil Co., has joined the oil and gas division of Citizens National Bank, Los Angeles.

Frank Whitson, development foreman for Phillips Petroleum Co., has been transferred to Morgan City, La., from Harvey, La.

J. V. Sexton, staff geologist in Houston for Pan American Petroleum Corp., has been named Gulf Coast division operations geologist. **Ray C. Morris,** area geologist in Liberal, Kans., has been named division operations geologist in the central division, Oklahoma City.

J. Gregory Merrion has resigned as southwestern district engineer for British-American Oil Producing Co. to open offices in Farmington, N. M., as consulting petroleum engineer. He had been with British-American since 1951.

Dr. Rex E. Lidov has been appointed director of research planning for Scientific Design Co. He will headquarter in New York. **Dr. Joseph L. Russell** has been named director of research and will be in charge of activities of the company's Little Ferry, N. J., research center. In other appointments at Little Ferry, **Dr. Robert S. Barker** has been named assistant director for special projects. **Mitchell Becker** has been named assistant director for project research. **C. B. Bormann** has been named assistant director for engineering services, **Edmond E. Bouvier,** assistant director for analytical research, and **Dr. Charles N. Winnick,** assistant director for exploratory research. **Jack B. Feder** and **Dr. Richard L. Golden** have been named section heads, project research.

Jesse L. Boyce, Jr., superintendent of American Gilsonite Co.'s Gilsonite, Colo., refinery, has been promoted to refinery manager. He succeeds **L. P. Morris,** who has been transferred to Standard Oil Co. of California, an affiliate.

Newton L. Lang, petroleum engineer with Amerada Petroleum Corp., has been transferred to Monument, N. M., from Bloomington, Tex.

Marshall L. Mason, Jr., geological and geophysical coordinator of Union Oil Co.'s West Texas division in Midland, Tex., has been promoted to assistant geological coordinator, United States and Canada. He will headquarter in Los Angeles.

William R. McCann has joined the production and exploration department of Monsanto Chemical Co.'s Lion Oil division in Houston. He had been with Texas Eastern Transmission Corp. there. **David A. Rochna** has joined Lion Oil in Denver.

Ernest Artz, superintendent of operations at the U. S. Air Force fuel plant in Model City, N. Y., operated by Olin Mathieson Chemical Corp., has joined SunOlin Chemical Co. as process engineering assistant.

T. H. Wallace, vice president of Western Gulf Oil Co. in Los Angeles, has retired. Activities of the company will be supervised by **A. M. Bell, Jr.,** vice president in Denver. In other Western Gulf changes, **T. F. Wissenbach,** manager of services, and **Paul O. Broxon,** divisional attorney, both in Los Angeles, have retired. **Don Gilkison,** exploration manager, has been transferred to Bakersfield, Calif., from Denver.

▶▶▶ Personals

R. W. (Bob) Wire, retired president of Loffland Brothers Co., has joined Western Industries, Inc., Tulsa, as vice president in charge of sales. Western Industries, specializing in construction, engineering, and management for the oil industry and related fields, was originally organized in 1952 but has been inactive for several years. **Paul C. Wallack,** president of the recently liquidated Walco Engineering & Construction Co., is president of the reorganized Western Industries. **Marvin E. Fox** is vice president, engineering, and **Parker E. Capps** is vice president, secretary, and treasurer. Fox and Capps were formerly with the Walco company.

WIRE

Floyd E. Stanley has resigned as president of Houston Corp. but will continue as chairman of the company. A successor as president has not been named as yet.

Hobson L. Mann has joined King-Stevenson Oil Co., Inc., as southwest division production engineer in Oklahoma City. He was with Bodard Drilling Co. and Sunray Mid-Continent Oil Co. before joining King-Stevenson.

W. K. Smith, senior exploitation engineer in Shell Oil Co.'s Midland, Tex., area, has been named chief exploitation engineer for the area. **R. L. Rankin,** chief mechanical engineer in

(Continued on page 164)

▶▶▶ Deaths

Julian Sage Burrows, 64, retired marine department manager for Humble Oil & Refining Co., died July 7 in a Houston hospital. Burrows retired in 1958.

Edwin Scott Mardock, 52, Tulsa consultant, died July 10 in a Tulsa hospital. Mardock was with Shell Oil Co. and Well Surveys, Inc., before becoming a consultant last year.

James A. Ahearn, 58, executive vice president, chairman of the executive committee and a director of Sinclair Refining Co., died July 11 at an Englewood, N. J., hospital after a brief illness. He had been with Sinclair Refining since 1924. He was manager of the company's transportation, supply, and distribution department before being named executive vice president in 1958.

Ralph C. Steinman, 62, Oklahoma City independent operator, died July 10 in a Tulsa hospital of cancer. Steinman was chief scout for Sinclair Oil & Gas Co. in Tulsa before becoming an independent in 1951.

Charles Howard Couch, 41, assistant district superintendent for Continental Pipe Line Co.'s Rocky Mountain district, died recently at his home in Casper, Wyo.

John R. Ramsey, 80, retired chief attorney for Texaco Inc. in Oklahoma and Kansas, died July 8 in a Tulsa hospital. Ramsey retired in 1946 after 30 years with Texaco.

Ted Scott, 47, Oklahoma district superintendent for Lone Star Producing Co., died July 5 in a Duncan, Okla., hospital after a heart attack.

John H. Cummins, 69, manager of Wilshire Oil Co.'s asphalt department, died July 2 in a Los Angeles hospital.

This is not an offering of the Debentures for sale, or a solicitation of an offer to buy any of such Debentures. The offering is made only by the Prospectus.

NEW ISSUE

$10,000,000

PAULEY PETROLEUM INC.

5¾% SUBORDINATED DEBENTURES

DUE JUNE 1, 1976

CONVERTIBLE INTO COMMON STOCK AT $21.00 PER SHARE *(subject to adjustment as set forth in the indenture)* ON OR BEFORE JUNE 1, 1970.

PRICE 100%
PLUS ACCRUED INTEREST FROM JUNE 1, 1960

Copies of the Prospectus may be obtained in any State only from such of the undersigned and other dealers as may lawfully offer these securities and distribute the Prospectus in such State.

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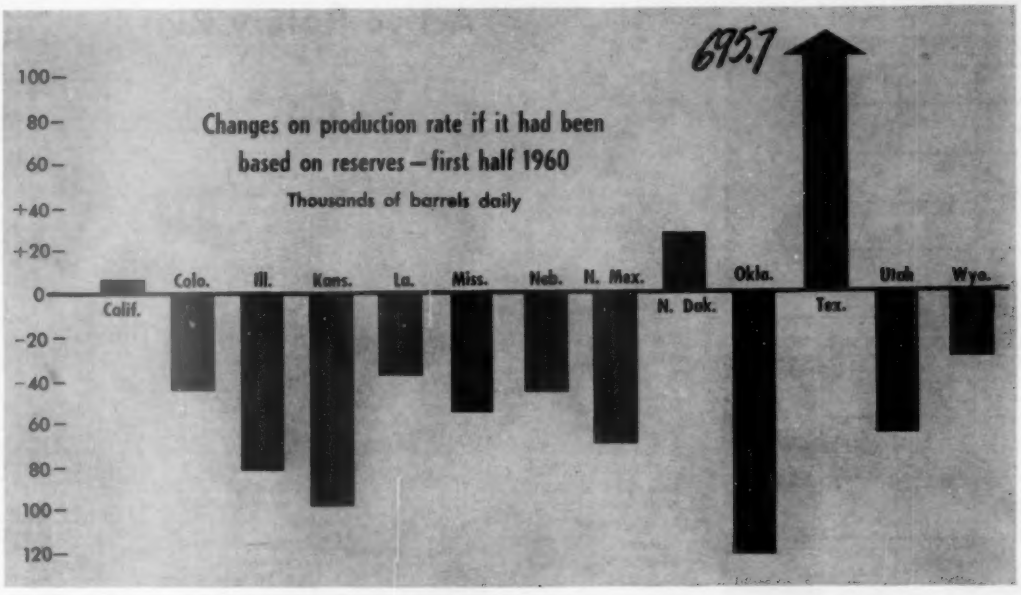
STONE & YOUNGBERG WILSON, JOHNSON & HIGGINS

July 12, 1960



State production doesn't follow reserves

BY JOHN C. CASPER

CRUDE PRODUCTION averaged about 7,042,500 bbl. daily for the first half of the year for a reduction of almost 152,000 bbl. daily from the average for the first half of 1959.

Production in Texas was down 245,000 bbl. daily in the first half or more than the cut in total production. But Texas production was up last year following a sharp drop in 1958.

Production was up in eight of the important producing states. Some of the increases were in states that exercise a measure of control over production. Others were in nonprorating states.

Production changes for the past few years have been influenced by sharp shifts in demand for crude. There were big increases in the spring of 1957 for those areas with pipelines to the Gulf Coast because of the Suez crisis. These same areas had cuts in production the following year.

These abnormal changes by areas tend to show the need for some method of estimating "normal" production for each state. Someone has suggested that a state's share of the over-all market should be related to crude reserves of that state. There are many limiting factors such as available transportation, percentage of production from stripper areas, discovery allowables, and local markets.

Without adjustment for any of these conditions, the table shows actual production in the first half and what it would have been if the total had been prorated according to published data on crude reserves.

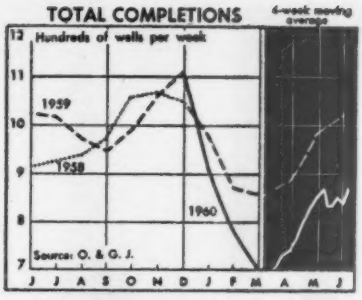
The chart shows how much production would have shifted by states if the totals had been determined by reserves. It is easy to see why Texas producers would welcome such a distribution of the total market.

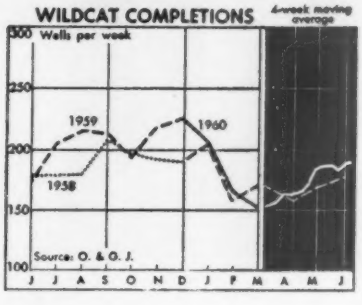
CRUDE PRODUCTION BY STATES
(Thousands of barrels daily)
(First half of 1960)

	Production based on reserves	Actual production
Alabama	7.6	17.4
Arkansas	69.4	77.8
California	835.4	830.7
Colorado	84.6	128.1
Illinois	132.0	213.7
Indiana	16.4	31.9
Kansas	203.7	303.2
Kentucky	30.3	61.2
Louisiana	1,034.7	1,072.7
Michigan	12.3	36.3
Mississippi	86.4	140.4
Montana	68.7	80.9
Nebraska	17.9	62.5
New Mexico	227.7	297.8
New York	7.6	5.0
North Dakota	84.8	56.7
Ohio	16.5	13.6
Oklahoma	414.0	534.5
Pennsylvania	25.2	16.7
Texas	3,299.2	2,603.5
Utah	43.2	107.4
West Virginia	11.4	6.0
Wyoming	311.5	341.9
Other	2.0	2.6
Total	7,042.5	7,042.5

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,829,000	UP	27,000	UP	27,000
Crude stocks	254,676,000	DOWN	2,982,000	DOWN	15,612,000
Completions	919	UP	110	UP	41
Refinery runs	8,280,000	DOWN	15,000	UP	444,000
Gasoline stocks	201,302,000	DOWN	414,000	UP	8,550,000
Kerosine stocks	28,755,000	UP	1,206,000	UP	261,000
Distillate stocks	116,730,000	UP	5,008,000	DOWN	9,088,000
Residual stocks	42,679,000	UP	1,440,000	DOWN	11,670,000
Four-product stocks	389,466,000	UP	7,240,000	DOWN	11,947,000
Total imports	1,691,900	UP	202,000	UP	293,800





Active Rotary Rigs

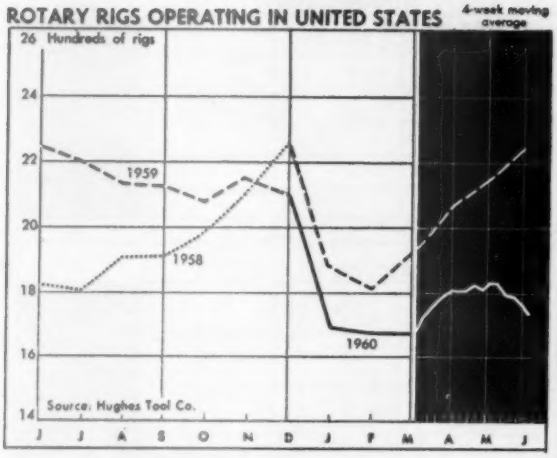
	7-11-60	7-4-60	7-13-59
Alabama	3	4	8
Alaska	5	4	(†)
Arkansas	13	12	17
Arizona	0	0	1
California	84	81	93
Land	79	76	88
Offshore	5	5	5
Colorado	29	27	51
Florida	3	2	1
Land	3	2	0
Offshore	0	0	1
Illinois	39	42	41
Indiana	7	8	10
Iowa	0	0	2
Kansas	112	103	145
Kentucky	5	4	8
Louisiana	291	287	377
North	44	41	38
S. Inland waters	111	113	153
S. Land	82	81	130
Offshore	54	52	56
Maryland	1	1	0
Michigan	37	36	25
Mississippi	56	55	65
Missouri	1	1	1
Montana	24	27	26
Nebraska	26	32	23
Nevada	0	0	1
New Mexico	102	108	121
New York	0	0	1
North Dakota	17	15	23
Ohio	4	6	4
Oklahoma	167	174	245
Oregon	0	0	0
Pennsylvania	8	11	2
South Dakota	0	0	0
Texas	566	569	759
S. Inland waters	6	5	8
S. Land	177	161	199
Offshore	1	2	0
North	53	51	162
Panhandle	34	42	(*)
East	49	46	(*)
West Central	150	166	239
West	96	96	151
Utah	36	35	30
Washington	0	0	1
West Virginia	4	4	9
Wyoming	70	69	91
Total U. S.	1,710	1,717	2,191
Western Canada	143	143	141
Eastern Canada	1	2	0
Grand total	1,854	1,862	2,332

Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. †Data first reported 4-4-60.

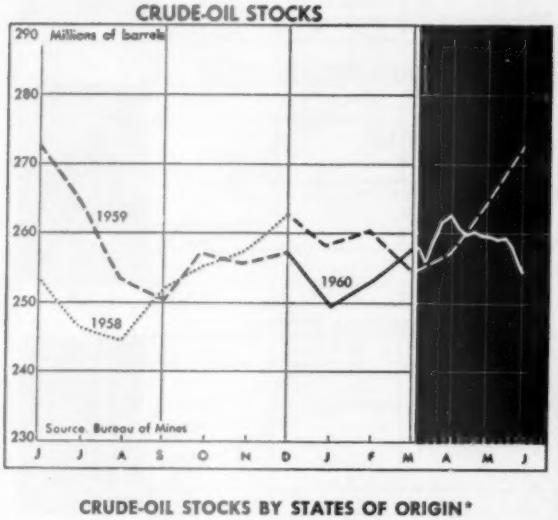
WEEKLY WELL COMPLETIONS . . . WEEK ENDED JULY 9, 1960

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	0	0	0	0	0	0	0	27	53	0	0	0	0	0	1	10
Arizona	2	0	0	0	2	0	2,915	10	.....	2	0	0	0	2	10	.....
Arkansas	23	14	0	1	8	0	79,979	325	441	5	0	0	1	4	84	75
California	48	41	0	1	6	0	159,537	758	801	2	1	0	0	1	139	188
Colorado	12	3	1	0	8	0	41,920	325	374	7	0	1	0	6	158	223
Illinois	39	10	0	0	18	11	80,309	1,031	1,090	0	0	0	0	5	230	177
Indiana	17	3	0	0	14	0	30,679	486	408	8	1	0	0	7	186	138
Kansas	43	19	0	1	22	1	147,822	1,693	2,062	14	1	0	0	13	553	465
Kentucky	49	25	0	4	19	1	53,393	832	1,299	9	2	0	2	5	100	77
Louisiana	77	24	6	12	35	0	600,583	1,795	1,847	15	2	0	1	12	283	233
North	45	12	0	12	21	0	146,084	640	666	9	0	0	1	8	134	93
South	28	10	6	0	12	0	314,698	883	979	5	2	0	0	3	130	131
Offshore	4	2	0	0	2	0	39,801	272	209	1	0	0	0	1	19	9
Michigan	40	19	0	1	15	5	131,467	412	318	8	0	0	1	7	116	77
Mississippi	11	6	0	0	5	0	115,449	373	328	3	2	0	0	1	132	154
Montana	9	1	0	2	6	0	33,648	156	161	3	0	0	0	3	72	55
Nebraska	23	7	0	0	16	0	113,727	422	427	8	0	0	0	8	166	183
New Mexico	35	20	1	5	9	0	173,094	966	983	7	0	1	0	6	149	118
West	14	3	0	5	6	0	58,734	314	443	6	0	0	0	6	35	36
East	21	17	1	0	3	0	114,360	652	540	1	0	1	0	0	114	82
New York	18	9	0	0	2	7	29,016	179	149	0	0	0	0	0	21	13
North Dakota	6	1	0	0	5	0	34,210	157	265	4	0	0	0	4	39	52
Ohio	20	11	0	3	5	1	34,101	522	505	0	0	0	0	0	27	14
Oklahoma	70	37	1	5	26	1	338,814	2,040	3,103	13	3	0	2	8	399	453
Pennsylvania	0	0	0	0	0	0	0	311	311	0	0	0	0	0	8	5
South Dakota	1	1	0	0	0	0	8,667	16	.....	0	0	0	0	0	6	.....
Texas	315	161	6	23	118	7	1,345,925	8,343	10,021	64	5	1	2	56	1,675	1,847
Dist. 1	16	6	0	0	10	0	48,150	564	599	8	0	0	0	8	214	167
Dist. 2	15	3	0	2	10	0	117,074	395	421	8	0	0	0	8	98	120
Dist. 3	22	14	0	1	7	0	115,781	642	596	1	0	0	0	1	118	123
Dist. 4	24	11	1	3	9	0	114,367	572	671	6	1	0	1	4	166	166
East	22	10	2	0	10	0	101,640	663	584	4	0	0	0	4	137	119
Dist. 7-B	35	14	0	9	12	0	120,787	1,190	1,405	7	1	0	0	6	335	373
West	96	67	0	1	22	6	424,546	2,240	3,117	18	2	0	1	15	350	393
Dist. 9	52	19	0	0	33	0	146,784	1,533	1,916	9	1	0	0	8	218	326
Dist. 10	33	17	3	7	5	1	156,796	544	712	3	0	1	0	2	39	60
Utah	5	3	0	0	2	0	28,176	137	174	1	0	0	0	1	46	48
West Virginia	35	6	0	27	1	1	80,250	397	382	0	0	0	0	4	4	10
Wyoming	21	13	0	1	7	0	97,357	530	473	5	0	0	0	5	215	162
Miscellaneous	0	0	0	0	0	0	0	75	62	0	0	0	0	0	69	31
Total U. S.	919	434	15	86	349	35	3,761,038	22,318	26,037	183	17	3	9	154	4,888	4,808
Previous week	809	373	17	51	362	6	3,543,671	.....	.....	205	19	0	4	182	.....	.....
Cum. 1960	22,318	10,514	673	1,781	8,716	634	97,377,322	.....	.....	4,888	436	53	160	4,239	.....	.....
Cum. 1959	26,037	13,316	638	1,881	9,522	680	107,425,298	.....	.....	4,808	480	70	145	4,113	.....	.....
Western Canada	49	28	0	10	10	1	231,350	1,093	1,290	7	0	0	5	2	306	389

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	7-2-60	6-25-60	7-4-59
Pennsylvania	2,133	2,134	2,488
Other Appalachian	1,717	1,731	2,082
Illinois, Indiana, Michigan	10,050	10,152	9,623
Nebraska and North Dakota	2,864	2,911	2,732
Kansas	9,670	9,646	10,197
Oklahoma	18,063	18,513	16,799
Arkansas	2,067	2,017	2,155
Louisiana	18,892	19,471	19,481
North	3,244	3,271	3,201
South	15,648	16,200	16,280
Mississippi, Alabama, Florida	2,147	1,843	2,604
New Mexico	8,335	8,153	8,333
Texas	105,770	106,804	117,309
East Texas	8,529	8,534	8,941
West Texas	47,695	48,317	56,333
Texas Gulf	17,893	18,763	18,986
Other Texas	31,653	31,190	33,049
Wyoming	17,851	18,270	15,800
Other Rocky Mountain	10,132	10,225	9,768
California	29,062	28,912	32,926
Foreign	†15,923	16,876	20,848
Total	**254,676**	257,658	273,145

*Bureau of Mines. †Includes 4,023,000 bbl. in California.

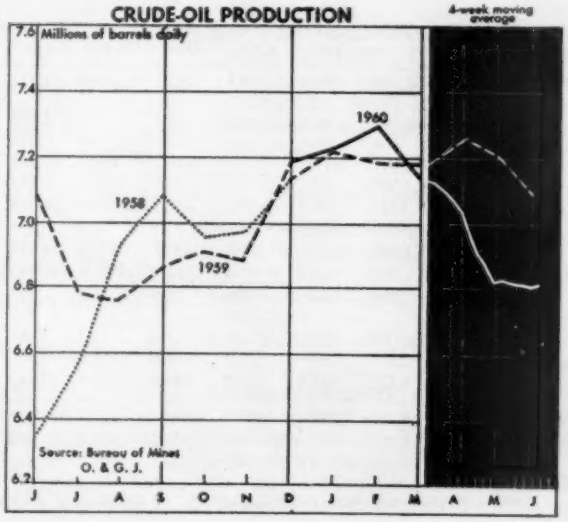
DAILY AVERAGE PRODUCTION FOR WEEK

	July 9, 1960 Crude oil	Lease condensate	Total	July 2 total
Alabama	17,775	.....	17,775	17,725
Arkansas	78,475	125	78,600	78,575
California	835,700	.....	835,700	836,000
Colorado	126,800	.....	126,800	124,200
Eastern	41,600	.....	41,600	40,000
Florida	1,000	.....	1,000	1,000
Illinois	212,200	.....	212,200	210,400
Indiana	32,400	.....	32,400	32,400
Kansas	†288,120	.....	†288,120	†281,590
Kentucky	63,400	.....	63,400	63,300
Louisiana	943,500	118,150	1,061,650	1,050,600
North	107,500	5,650	113,150	113,100
South	836,000	112,500	948,500	937,500
Michigan	41,500	.....	41,500	40,500
Mississippi	134,000	3,600	137,600	136,750
Montana	80,400	.....	80,400	77,600
Nebraska	68,700	.....	68,700	68,000
Nevada	100	.....	100	100
New Mexico	284,000	7,000	291,000	288,500
North Dakota	58,900	.....	58,900	61,700
Oklahoma	†517,100	.....	†517,100	†493,200
Texas	2,349,000	85,800	2,434,800	2,461,900
Dist. 1	41,000	2,500	43,500	45,000
Dist. 2	97,000	8,100	105,100	108,200
Dist. 3	310,000	36,000	346,000	351,000
Dist. 4	161,000	17,000	178,000	181,000
Dist. 5	26,000	300	26,300	26,350
Dist. 6	101,000	8,900	109,900	111,000
East Texas field	122,000	.....	122,000	123,000
Dist. 7-B	126,000	150	126,150	126,150
Dist. 7-C	116,000	3,300	119,300	119,825
Dist. 8	949,000	7,000	956,000	964,500
Dist. 9	193,000	1,700	194,700	197,900
Dist. 10	107,000	850	107,850	107,975
Utah	98,600	.....	98,600	101,400
Wyoming	339,700	.....	339,700	335,000
Others	‡1,350	.....	‡1,350	‡1,200
Total U. S.	6,614,320	214,675	**6,828,995**	6,801,640
Change from prev. week, up		.....	**27,355**	.....
Canada	†486,300	.....	†486,300	†527,100

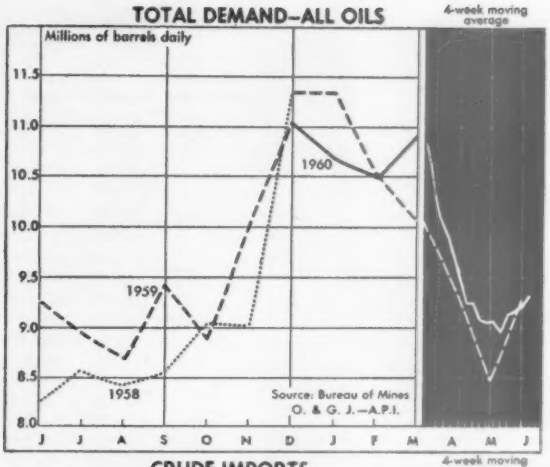
Total U. S. Prod.-Jan. 1-July 9 ..... 1,342,587,200 bbl.
Same period last year (crude plus cond.) ..... *1,363,341,900 bbl.

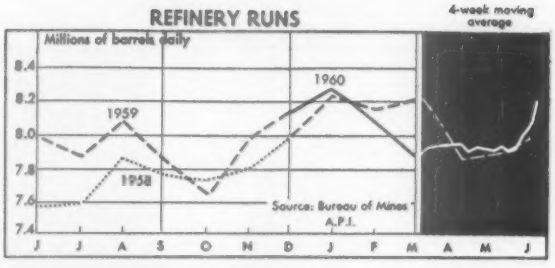
*Includes 36,146,300 bbl. condensate. †Week ended previous Monday. ‡Alaska and South Dakota.

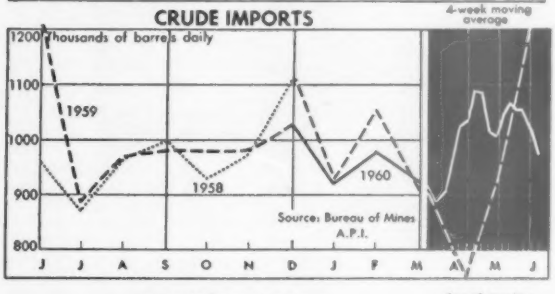
CRUDE-OIL PRODUCTION

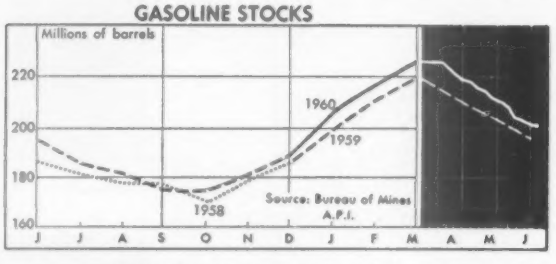


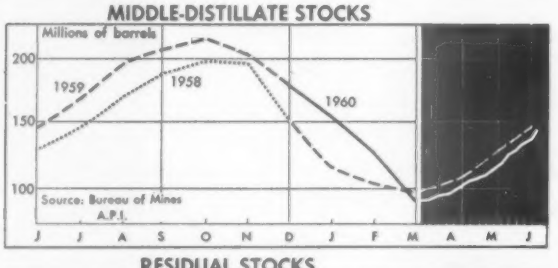
REFINING

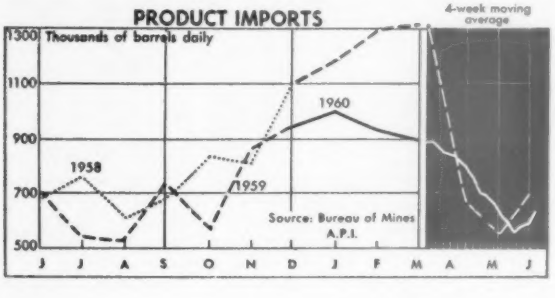


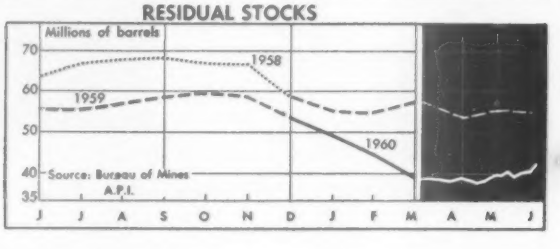












API REFINERY REPORT—JULY 8, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, July 1959 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,160	580.1	37.3	361.3	151.4	45,373	10,662	41,191	12,638	1,101	522.0	13.3	325.6	160.0
Appalachian:														
District 1	97	42.1	4.0	21.7	7.3	6,200	650	2,570	412	92	40.8	3.0	21.5	4.2
District 2	109	56.6	1.1	19.6	8.6	2,874	312	1,127	246	107	59.5	1.1	20.5	8.3
Ind., Ill., Ky.	1,495	813.7	70.3	306.4	150.3	35,714	5,864	20,562	5,266	1,413	737.5	68.5	282.6	119.8
Minn., Wis., Dak.	125	57.3	12.3	28.7	17.1	6,851	1,289	5,191	618	115	55.5	7.7	26.5	11.1
Okla., Kans., Mo.	746	408.0	16.4	172.1	20.7	18,359	1,408	9,627	1,073	709	386.8	11.5	166.3	18.5
Inland Texas	319	241.4	6.0	51.7	16.4	6,794	553	1,531	2,484	294	229.6	6.6	49.3	24.8
Tex. Gulf Coast	1,936	1,010.0	129.1	457.6	138.3	24,610	3,596	13,218	4,565	1,737	914.2	56.5	405.9	127.8
La. Gulf Coast	707	402.6	67.4	168.1	55.7	10,792	1,656	5,256	1,521	712	395.2	47.2	166.2	44.7
N. La. and Ark.	110	64.6	6.6	20.9	5.3	5,797	904	2,045	138	69	28.5	1.8	14.0	4.2
Rocky Mountain:														
New Mexico	29	16.9	0.7	5.4	2.7	660	34	164	14	27	13.8	0.5	5.2	2.3
Other Rky. Mt.	312	137.3	4.4	66.0	36.6	6,163	323	2,294	924	327	144.8	3.1	67.3	35.1
West Coast	1,135	551.8	28.0	184.9	253.3	31,115	1,504	11,954	12,780	1,178	547.7	3.9	167.8	262.1
July 8, 1960	8,280	4,382.4	383.6	1,864.4	863.7	201,302	28,755	116,730	42,679	7,881	4,075.9	224.7	1,718.7	822.9
July 1, 1960	8,295	4,275.6	365.3	1,851.3	855.4	201,716	27,549	111,722	41,239	.....	.....	.....	.....	.....
July 10, 1959	7,836	4,062.0	234.9	1,636.7	923.7	192,752	28,494	125,818	54,349	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Jules-burg	Wyo. (sour)
14-14.9	$1.76	....	....	....	....	....	....	....	....
15-15.9	1.84	....	....	....	....	....	....	....	$1.81
16-16.9	1.92	....	....	....	....	....	....	....	1.86
17-17.9	2.00	....	....	....	....	....	....	....	1.91
18-18.9	2.08	....	....	....	....	....	....	....	1.96
19-19.9	2.16	....	....	....	....	....	....	....	2.01
20-20.9	2.24	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.32	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.39	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.23-3.53
Van	3.08
Pennsylvania Grade:	
Bradford	$4.70
Middle District	4.52
Southwest Pennsylvania	4.25
West Virginia	4.07
★ Buckeye Grade	3.98
Illinois Basin	**2.85-3.00**

Foreign

Middle East, Persian Gulf (cargoes f.o.b. lifting port):	
Arabian, about 34°, Ras Tanura	$1.90
Iranian, 34.0°-34.9°, Bandar Masur	1.86
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05
Middle East, E. Mediterranean:	
Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias (Grade A)	2.29
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57
Canada:	
Leduc-Woodbend	$2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 47°-47.9°, Tucupido	3.34
San Joaquin, 40°-40.9°, Puerto La Cruz	3.08
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

★ Gulf-NY, dirty (ATRS—25.0%)	$2.14
★ Carib.-Brazil (ATRS—52.5%)	2.54
★ PG-Japan, dirty (USMC—73.5%)	2.70
★ PG-UK, dirty (Scale—65.0%) (23s. 0d.)	3.22

★Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):	
★ Regular (91 octane)	11.75-12.00
★ Premium (99 octane)	14.50-14.75
Natural gasoline (26-70)	4.5
Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
★ Regular (90 octane)	10.50-10.75
★ Regular (92 octane)	10.75-11.00
★ Premium (98 octane)	11.75-12.00
California (rack) Los Angeles:	
Regular (88 octane)	11.65-12.15
Premium (94 octane)	12.65-13.15
Premium (100 octane)	14.00-14.65
Caribbean area (cargoes):	
Regular (87 octane)	10.00
Premium (97 octane)	11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):	
★ Kerosine 42-44	9.25
★ Diesel oil (58 d.i. and above)	9.00
★ Distillate No. 1	9.00
★ Distillate No. 2	8.00
Gulf Coast (cargoes):	
★ Kerosine 41-43	9.00-9.25
★ Distillate No. 2	8.25
New York Harbor (barges):	
Kerosine 41-43	10.05
Distillate No. 2	9.05
Diesel fuel, 48-52 d.i.	9.35
Caribbean area (cargoes):	
Distillate No. 2	8.125

Residual Fuel (Bbl.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.90
Gulf Coast (cargoes):	
Bunker C fuel	2.20-2.25
New York Harbor (barges):	
★ Bunker C fuel	2.52
Caribbean (cargoes):	
Bunker C	$2.10
California (rack):	
Bunker C fuel, Los Angeles	$2.15

★Denotes change from previous week.

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WESTERN STATES: (California, Washington, Oregon, Idaho, Nevada, Utah, and Arizona) Write: Classified Departments, Inc., The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles 8, Calif. Phone AXminister 2-0287.

FOR SALE EQUIPMENT

TWO REDA PUMPS for 5½" casing complete with control panels, No. 4 cable and protecters. One with transformer and generating unit. For additional information contact Tennessee Gas Transmission Company, Box 163, Great Bend, Kansas.

WELL DRILLS, core drills. Everything for well and core drilling. New and used equipment at money saving prices. Everything in supplies. Nationwide sales. Send for bulletins—Pressey & Son, Pueblo, Colorado.

PACKAGED WORTHINGTON two stage compressor. Like new—used four months. Size compressor cylinders 8" x 11" and 12" x 11" with LeRoi L-3000 engine. Complete with Happy two stage gas cooler, Vargo engine speed controller, Masonilan pressure controller and automatic lubricator oiling system. Price $22,500.00. Alvin Johnson, Phone 6661, Oil City, Louisiana.

LIQUIDATION
at ESSO REFINERY Balto., Md.

TOWERS

10' x 145'—125 PSI 50 trays
9'6" x 121'—325 PSI 36 trays
8'6" x 103'—165 PSI 24 trays
7'0" x 82'— 75 PSI 36 trays
6'0" x 80'—300 PSI 36 trays
4'0" x 44'—150 PSI 12 trays
3'6" x 36'—400 PSI 12 trays
2'6" x 52'—360 PSI 22 trays
2'2" x 57'— 85 PSI 4 trays

HEAT EXCHANGERS—CONDENSERS

Steel Tube ..... 7,500 to 100 sq. ft.
Adm. Tube ..... 3,500 to 236 sq. ft.
Cu Ni Tube ..... 2,330 to 308 sq. ft.
S. S. Tube ..... 1,000 to 170 sq. ft.
BLOWERS—11,880 CFM @ 11 PSIG
INSTRUMENTS—Controllers, Recorders, Indicating and Transmitting
MOTORS—10 HP to 500 HP XP
PIPE CHROME—3¾" to 14" OD
PUMPS—Hot Oil, Steam, Centrifugal
REACTOR—9' x 32'6" OA
REBOILERS—2,700 to 450 sq. ft.
TRANSFORMERS—5 KVA to 333 KVA
VALVES—Diaphragm, Butterfly Slide and Pressure Regulating
VESSELS PRESSURE—3' to 12' Dia.

PETRO CHEM FURNACE
1.9 MILLION BTU NEW 1949

WRITE FOR COMPLETE CATALOG

HEAT & POWER CO. INC.
60 East 42nd St., New York 17, N.Y.
310 Thompson Bldg., Tulsa 3, Okla.
Box 5203, Baltimore 24, Maryland

FOR SALE EQUIPMENT

FOR SALE—Star 76 top to bottom rig 3,500' capacity 3 sets of tools 12" to 4" dog house hand tools light plant nothing else to buy. Ready to Drill. Located Central Kentucky. Koons, 222 North 8th St., Mt. Vernon, Illinois.

FOR SALE gasoline plant, shut down June 1, 1960. Will start dismantling immediately. Pumps, motors, engines, compressors, Tanks, towers, pipe, buildings and miscellaneous equipment. Three miles west of Burrton, Kansas. Representative will be at plant site Tuesday, Wednesday and Thursday of each week. Contact Cowden, Cities Service Oil Company, Bartlesville, Okla.

—PIPE—

2,000,000 ft.	2"	3.50# to the ft.
1,000,000 ft.	3"	7.70#
1,000,000 ft.	4"	10.98#
500,000 ft.	6"	19.80#
200,000 ft.	6 5/6"	28#
400,000 ft.	10¾"	35#
75,000 ft.	12¾"	40#
10,000 ft.	16"	42#

All No. 1 Grade plain end and cleaned.
INDIANA-OHIO PIPE CO.
P. O. Box 5412 Shep. Sta.
Columbus 19, Ohio
Phone CL 3-5527

NEW CROLOY 5 HEATER TUBES
Priced at ½ New Cost
Must Move at Once

14—3¾" x ⅜" wall x 44' long
63—4" x ⅜" wall x 28' long
10—4" x ⅜" wall x 32' long
50—4" x ½" wall x 32' long
3—5" x ½" wall x 42' long
42—6" x ½" wall x 27' to 47' long

HEAT & POWER CO., INC.
60 E. 42nd St., N. Y. 17, N. Y.
310 Thompson Bldg., Tulsa 3, Okla.

FOR SALE EQUIPMENT

THOR AIR drills: Model WB 62-reversible. Unused gov't. surplus 2" cap. in wood. $69.00 cash. F.O.B. The Drill & Service Company, P. O. Box 54, Wyoming, Pa.

WALKER-NEER 32-S, trailer-mounted, new lines, $12,000, complete. Two drilling contracts included if purchased July. F. D. Mayfield, Box 436, Manchester, Kentucky.

SEISMIC EQUIPMENT—Two Electro-Tech DS-7 magnetic tape recorders equipped for record and/or playback. In good condition with only 18 months total use. Box L-912, The Oil and Gas Journal, Tulsa, Oklahoma.

SEISMIC INSTRUMENTS—Three sets of Century 501 recording instruments either truck mounted or rigged for lab. use. Box L-911, The Oil and Gas Journal, Tulsa, Okla.

ROTARY DRILLING RIG, Failing 2000, truck mounted 5 x 10 Gardner-Denver pump. Approximately 2,500 ft. 2⅞ drill pipe. Rig now in operation, Henderson County, Ky. Agent John Scott—Box 163, Sebree, Ky. Phone TE 5-7566.

FOR SALE

2,000 ft. 24" O.D. new spiral weld.
.250 wall . . . 63.41# per ft. Plain end.
B. F. W.—prime—50 ft. lengths.
Wire, write, or phone

COLUMBUS STEEL SUPPLY
1000 BONHAM AVE. • AX 4-4461
COLUMBUS, OHIO

FOR RENT OR LEASE

Realistic Rates—Attractive Purchase Option

N-4 BREWSTER "Bobtail" torque converter rig complete. Draw works powered by two Waukesha 6WAK engines. With G-D 7¼" x 12" unitized pump powered by LeRoi 12-cylinder engine, 93' Lee C. Moore mast on 6½' substructure, BJ hook, Brewster block, swivel and rotary table, vibrating shale shaker, Regan blowout preventer, nine drill collars, 5600' of excellent 4" O.D. drill pipe. With necessary piping, fittings and accessories. Located at Oklahoma City.

•

133' IDECO "Full View" mast on 8' high x 36'10" long substructure, with steel flooring, stairways and accessories. Located at Odessa, Texas.

•

Also other drilling and production equipment for rent or term lease.

LUCEY

LUCEY PRODUCTS CORPORATION
624 So. Cheyenne Tulsa 19, Oklahoma
Phone: LUther 4-4711
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FOR SALE EQUIPMENT

TWO PERFORATING trucks with lines completely equipped with or without radioactivity logging equipment. These trucks are in excellent condition and ready for immediate use. Box L-897, The Oil and Gas Journal, Tulsa, Oklahoma.

3 APP. 100 H.P. Oilfield Firebox Type Steam Boilers insurable for about 200 to 225#. Excellent condition. Bargain $1,500.00 each F.O.B. our yard. Write or Phone M. KAPLAN & SON, INC. Monroe, Louisiana. Fairfax 2-5112.

ONE Littleford dope pot 30 barrel and, one side boom TD 18A International. Will sell cheap. Superior Manufacturing Company, Amarillo, Texas. Phone Drake 3-4395.

1—1958 FAILING, special model 1500 rotary drill, only cut 2,000 feet of hole. Machine equipped with 2⅞" H. D. retracting rotary drill head, with 20' hydraulic stroke feed, Gardner-Denver 5 x 8 mud pump powered by separate IHC U-450 gas engine, 42' tubular steel mast, model Q-54-A P. T. O. friction clutch sand reel assembly with double brake bands, double brakes on hoisting drum, automatic pull-down assembly, heavy duty mast platform and rod rack, 8⅝" opening H. D. power break-out table, hydraulic breakout cylinder, tonglines and counter-weights, S-1050-AH. D. bail-type water swivel, 2⅞" x 26', 6" round fluted Kelly, 50 Joints 2⅞" x 20' drill pipe mounted on International 172 tandem truck, actual mileage 1,387 and misc. extra tools. Cost new $36,000. Priced for quick cash sale at $21,500. For further details write or phone Union Pipe & Supply Company, Owensboro, Ky.

FOR SALE OR LEASE: Acidizing unit—P-46 Oilwell pump, 1,000 gallon tank, mounted on single axle International truck. Box L-909, The Oil and Gas Journal, Tulsa Okla.

MOTOR VESSEL FOR CHARTER—Heavy duty cable, work, and cargo vessel available with or without crew in U. S. A. or overseas. 155 feet L.O.A., 36 foot beam, 950 tons full load displacement. Anthony Zahardis, North Country Road, Mount Sinai, New York.

185' DRILLING BARGE

Single hull slotted drilling barge, 185' x 38' x 13', with derrick substructure, reserve mud tanks, slush sand settling pits, deck fuel and water tanks, tool house and change locker house. Built 1950. Barge has Deckard all-galvanized derrick flood windbreak for 136' Emsco 18 ARH-1 derrick; rig and mud line manifold and associated equipment; Mid-Continent engine substructure, 3 sections, each 19'4" long x 7'4" high x 7' wide; Mid-Continent engine house, 36'6" long x 19'4" wide, and shed-type roof.

Barge is docked at Humble's slip on the Harvey, Louisiana canal and is offered for sale on an as-is, where-is basis. Inspect by contacting Mr. W. O. Foster at Humble's office on the Intracoastal Canal at Harvey.

Bids must be mailed to Westbrook Teer, Humble Oil & Refining Company, P. O. Box 2180, Houston 1, Texas. Bids must be received prior to 9:00 AM, September 1, 1960. Humble reserves the right to reject any and all bids.

HUMBLE OIL & REFINING COMPANY

LIQUIDATION

at Koppers Co.—Monaca, Penna.
Oil Cracking Plant—1949

TOWERS, 14 ft. to 99 ft.
EXCHANGERS, 75 sq. ft. to 6,370 sq. ft.
CENT. PUMPS, 5 to 4,000 GPM
FURNACES, Petroleum, Alcorn and B & W types.
TANKS, 500 to 850,000 gal.
VALVES, from 1" to 18" Forged Steel, Approx. 3,000 to 4,000
COMPRESSORS, Ingersol-Rand, steam, type XPV.
INSTRUMENTS, Foxboro, Leeds & Northrop.

(FOR SALE—as a plant or by item. Contact Rochester-Coal-Trucking & Contracting Company)

Rochester Coal
Trucking & Contracting Company
1999 Beaver Road, Monaca, Pa.

FOR SALE EQUIPMENT

FOR SALE on bid basis—one operating gas plant and pipe line system, Magnolia, Arkansas, daily capacity approx. 23 MMCF, 90,000 gallons. Contact Shell Oil Company, Mr. O. H. Hanyka, Magnolia, or H. B. Grist, Express 1331, New Orleans, Louisiana.

PLATFORM TYPE power drilling rig, 14,000 ft. capacity for sale on a bid basis at Morgan City, Louisiana. Rig unitized for quick move. Contact Shell Oil Company, W. L. Brady at Morgan City, or H. B. Grist, Express 1331, New Orleans, Louisiana.

FOR SALE in excellent condition 8,353 ft. 3½" OD 13.30 grade D drill pipe with 3½" Hydril IF double boxes and twin pin subs; 1,896 ft. 3½" OD 13.30# grade D drill pipe with 3½" Hughes flush joints tool joints, w/lift plugs. System Oil & Gas Company, Meadows Building, Dallas Texas, Telephone EM 8-2202.

FAILING 1,500 long mast kellys. K. C. Franks number 5 x 6 pump. Others. 3¼ inch hexagon kellys, $125. Fred E. Butler, Box 481, Pueblo, Colorado.

SALES AND RENTALS. New or used portable floating bridges, trestle bridges and ferrys. Bub Gallaway, 4106 Ascot Lane, Houston, Texas. Phone OV 2-2334.

EQUIPMENT WANTED

WE ARE interested in the purchase of your depleted wells for salvage. Also, used casing, tubing, units, tanks, etc. Must be in Kansas area. The Buckeye Supply Company of Kansas, Inc., 105 S. Main, El Dorado, Kansas.

HELP WANTED

FOREIGN—DOMESTIC Employment Oil, Chemical, Industrial. Write for details without obligation. Accredited Personnel Services, P. O. Box 6006, New Orleans 14, La.

WANTED
SALES MANAGER

Young, Outgoing, Aggressive,

For A Superlative New Product Fibre Glass-Epoxy Pipe and Tubing For a Wide Range of Pressures For Oil Production and Chemical Industries.

Box L-906,
The Oil and Gas Journal,
Tulsa, Oklahoma.

HELP WANTED

FOREIGN EMPLOYMENT—foreign drilling superintendents, workover tool-pushers, cable tool drillers, rig mechanics. Also, refinery personnel, administrative and supervisory. Key Employment, 711 Main, Houston, CApitol 5-0727.

PETROLEUM ENGINEER—with production experience and sales ability, wanted by Houston Production Equipment Manufacturer. Box L-892, The Oil and Gas Journal, Tulsa 1, Oklahoma.

NEW OIL JOB Directory, foreign and domestic, showing where to apply for jobs. 500 selected producing, refining, butane and pipeline companies. Nationwide, $5.00 cash. OIML Co., Box 2603, Tulsa, Oklahoma.

SALESMAN or manufacturers representative for well known, established line of oil field chemicals, detergents and paint products. Box L-910, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

PETROLEUM ENGINEER—12 years diversified experience drilling and production, Texas and Louisiana Gulf Coast. Licensed Texas and Louisiana. Married, age 41. resume available. Box L-896, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM GEOLOGIST, B. S. University of Texas. 10 years major and independent experience. Subsurface and completion in Julesberg, Willston, Mid-Continent, two years recently in Kentucky. Age 35. Will relocate. Box L-899, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, 28, B.S. Oklahoma University. Currently in 6th year with leading major; experienced in reservoir evaluation, miscible displacement, unitization, and general production work. Interested in reservoir engineering position with independent, consultant, or financial institution. Complete resume on request. Box L-908, The Oil and Gas Journal, Tulsa, Okla.

REGISTERED CIVIL ENGINEER; age 34, family: 10 yrs. administrative, design, construction experience oil and mining industries in U. S. and Latin America; fluent Spanish. Resume on request. Box L-907, The Oil and Gas Journal, Tulsa, Oklahoma.

MATERIALS CONTROL AUDITOR. Nine years oil company experience. Age 36. Will relocate. Thomas Crowe, 5307 So. Detroit, Tulsa.

CHEMICAL ENGINEER. 19 years experience in petroleum engineering and multifunctional planning work, last 7 years in supervisory managerial posts, desires responsible position petroleum or petrochemical company. Write: Box L-863, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST-PALEONTOLOGIST

B.S. degree in Geology, 20 years major and independent oil company experience in geology in the U. S. Mid-Continent, California, South America, and the Middle East, familiar with micropaleostratigraphy, depositional environments, well correlations by lithology, foraminifera, ostracods, pollen and spores, residues, all types of well logs, geologic and magnetic surveys, ideas for drilling wells, wants retainer.

216 Knox Building Enid, Oklahoma

LEASE AND DRILLING BLOCKS

HAVE SEVERAL lease blocks South Georgia on Gravity Survey Highs. Want Drilling Deals with financially interested people or owner of portable slim hole rotary rig. You furnish rig, I'll furnish labor, material. Ready to go. Oil and Gas seepage on area. T. R. Davis, 601 Jackson St., Vidalia, Georgia.

LINCOLN CO., KENTUCKY—677 acres Jumbo section, production corniferous—175' to 300'. Older field nearby has produced for many years. One of Kentucky's shallowest fields. Oil Development Co., 1836 Euclid Avenue, Cleveland 15, Ohio.

WILDCATTERS: THIS IS IT! WALNUT, FALKNER, OWL CREEK STRUCTURE, four sites for 1,500 ft. oil. Eminent geologist's report. $2.00 acre reliable operators ONLY, SHALLOW OIL. 1369 Court, Memphis 4, Tennessee.

PARTNER TROUBLE—Sacrifice 289 acre lease in Barren County, Kentucky. Offset production on three sides, 2 wells—$35 per acre includes $5,000 worth new equipment. Ben Levy, 421 Maritime Bldg., New Orleans, Louisiana.

LEASE AND DRILLING BLOCKS

BOTTOM HOLE pay offset and close-in acreage to J Sand test 6800' 22-3N-61W Denver Basin. G. N. Babcock, Chanute, Kansas. Phone 1531.

HAVE 300 acres royalty for sale Ellis County Oklahoma in area which has good geology. Fletcher Bowles, Box 812, Oklahoma City. Phone CE 6-5405.

PROSPECTIVE OIL Land: Suitable townsite acreage in fee, E/35 acres, Sec. 16, Block JKL, PSL Survey, Hudspeth County, Texas, at intersection U. S. Highway 62 and F. M. 1437 Highway, South of Dell City, Texas. Write quickly, Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

759 ACRES ALLEN and Monroe Counties, Kentucky, available for sublease, assignment or drilling contract. Phone 6572, or write: Box 697, Oil City, Louisiana.

DRILLING DEALS available Cambridge arch area of Nebraska. All based on subsurface geology. 10 to 12 possible pays. Economics excellent. Major company support on many. William V. Wade, Consulting Geologist, Box 772, McCook, Nebraska.

FOR SALE—working interest in 160 acres offset to nice Bartlesville Sand, well 750 ft. Eastern Kansas. Box L-902, The Oil and Gas Journal, Tulsa, Oklahoma.

KENTUCKY—4,000 acres Pulaski County, $1.00 cash per acre, $1.00 oil payment per acre from 1/8. 10 year term leases 25 cent rental paid to January 1961. Assign all or any part. Investigate today. Write, wire, phone: W. V. Cravens, Russell Springs, Kentucky.

FOR SALE several thousand acres leases in Deep Edwards trend Texas. Scout Box 2274 Houston, Tex.

UNUSUAL VIRGIN PRODUCTION OPPORTUNITY

760 acre lease. Five 120 ft. wells just finished. Over 20 ft. sand section. Core laboratories reports 42% low gravity oil saturation and 1,341 barrels of original stock tank oil in place per acre foot. Ready market for oil assured. Natural gas, water and electricity on property. Location 90 miles of Tulsa on main highway. Here are millions of barrels of oil reserves at pennies per barrel, offered for cash and oil payments out of 1/8. Write owner—2719 East 61st, Tulsa, Okla.

PROVEN GAS RESERVES

Newly discovered gas field. Market nearby, suitable for storage. Interested purchasers may write for complete information. Box L-887, The Oil and Gas Journal, Tulsa, Oklahoma.

MONEY RAISING

HELP NEEDED—to finance drilling blocks. Information furnished on request. J. S. Lewis, 208 S. Bolton Street, Jacksonville, Texas.

FINANCING

CAPITAL needed to drill offset production in West Virginia oil bringing 4.07 at well. Gas—.25c per thousand, in West Virginia, big play. David W. Law. Phone: HU 5-8446, 716 Union Trust Building, Parkersburg, West Virginia.

MONEY AVAILABLE

For compensating balances

DAVID J. GREESS

RE 2-8346

320 B'way N.Y.C. 7, N. Y.

ROYALTIES

PRODUCING LAND Owners royalty for sale. 10 acres paying $27. month. Settled, under 160, 5,000 ft., major company. 3 more locations. $250.00 acre. Jimmy Nix, Box 3041, Oklahoma City, Okla.

FOR SALE: Oil and Gas Royalty under 500 acres in Scipio Oil field, Jackson Co., Michigan. Non producing offsets flowing, drilling on property soon. Also a farmout in trend. Donald Davis, Phone VI 9-9118, Jonesville, Michigan or Phone 972-2, Bluffton, Indiana.

FOR SALE AT BARGAIN: 500 acres, landowners royalty in Montana. Good geology. Contact V. B. West, 405 Amarillo Bldg. Amarillo.

PRODUCTION WANTED

PRODUCING PROPERTIES: Highest price paid for producing properties, including stripper production. Tex-Gas-Oil Investment Co., Inc. 601 Meadows Building, Dallas, Texas. Phone: Em 3-1693.

REAL ESTATE

MEXICAN RANCHES—Two 20,000 acre ranches west of Saltillo, Coahuila State, about 150 miles from border. Good title, $3.50 per acre, suitable for cattle or recreation. Box L-895, The Oil and Gas Journal, Tulsa, Oklahoma.

BUSINESS SERVICE

DELAWARE CORPORATIONS formed and serviced. American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

BUSINESS OPPORTUNITIES

FINANCIAL—Investment Banking Houses and Underwriters reached. Confidential. You can send the details of your proposition direct or thru your attorney to Consultant 817—51st Street, Brooklyn, N. Y.

NEW PRODUCTS WANTED—Well-established, responsible company with complete facilities for developing, manufacturing and marketing oil field equipment is seeking new or improved products, preferably patented or patentable to add to its presently well-known line. Royalty basis or outright purchase. Initial submission should identify product and general use without revealing engineering and confidential detail. Submissions will be handled promptly and confidentially. Box L-894, The Oil and Gas Journal, Tulsa, Oklahoma.

The City Public Service Board of San Antonio, Texas

REQUESTS PROPOSALS TO FURNISH FULL REQUIREMENTS OF NATURAL GAS

The gas is to meet requirements for distribution to customers through the City of San Antonio Gas Distribution System and for use in the steam-electric generating plants of the City Electric System, deliveries of gas to commence on or about April 1, 1962.

Estimates of annual requirements, load factor data, points of delivery and other pertinent data may be secured from:

O. W. Sommers,
General Manager
Navarro and Villita Streets
P. O. Box 1771
San Antonio 6, Texas

▶▶▶ Personals

(Continued from page 155)

Shell Oil Co. of Canada's Calgary area, has been transferred to Roswell, N. M., as division production manager. **J. E. R. Sheeler,** division production manager in Shell's old southern division, has been named Abilene, Tex., division production manager. The southern division has been divided to form new Abilene and Midland divisions. **V. J. Kennedy,** manager of the North Texas division, will be Abilene division exploration manager, with **R. J. Oliver** as division land manager.

Harry L. Krieger, chemist with Gulf Oil Corp. in Port Arthur, Tex., has joined W. R. Grace & Co. in Baton Rouge, La., as a chemist.

Guy E. Campbell, acting manager of Sun Oil Co.'s Mid-Continent production division in Tulsa, has been named division manager. **William R. Gannaway,** assistant division chief geologist, has been named assistant division manager, a new position. Gannaway will be succeeded by **J. Edward Green,** regional geologist. **Jack G. McQueen,** acting division manager, land department, has moved up to division manager, land department, and **Floyd T. Gates,** senior land man, has been named assistant division manager, land department.

J. A. Ries, geophysicist with Seismograph Service Corp., has joined J. J. Rupnik & Co., Tulsa exploration consulting firm.

James C. Henderson, production engineer with Gulf Oil Corp., and **Bascom R. Lynn,** Gulf Oil reservoir engineer, have formed Henderson & Lynn, consulting petroleum engineering firm, in Midland, Tex. The company will specialize in secondary recovery operations.

Martin A. Row, general attorney for Sun Oil Co.'s southwest production division, has been named counsel for Sun's regulatory and natural-gas matters, a new position. He will continue to headquarter in Dallas. **Charles F. Heidrick** has been transferred to Dallas from Beaumont, Tex., to succeed Row.

Jesse L. Kitchens, Jr., has joined the manufacturing department of Monsanto Chemical Co.'s Lion Oil division in Texas City. He was with American Oil Co. there.

F. M. Graves has resigned as assistant to the general manager of Mobil Oil Co.'s Beaumont, Tex., refinery to join American Independent Oil Co. in Kuwait.

John D. Stone, Gulf Coast division corrosion engineer for Sunray Mid-Continent Oil Co. in Houston, has resigned to open offices in Corpus Christi, Tex., as consulting corrosion engineer. Stone later plans to open offices in Lafayette, La., and Houston.

Eger V. Murphree, president of Esso Research & Engineering Co., has been elected a director of the Atomic Industrial Forum. Murphree has been a member of the Atomic Energy Commission's general advisory committee since 1957.

J. Guy Miller, vice president and manager of South Penn Oil Co.'s retail marketing department, will retire in October. Miller has been with the company and its affiliates since 1926. He was named a vice president in 1955.

Norman B. Adams, production engineer with Tidewater Oil Co., has been transferred to Monahans, Tex., from Hobbs, N. M.

John R. Foster, district geophysicist for Pan American Petroleum Corp. in Oklahoma City, has been transferred to Shreveport.

E. J. Pratt has been promoted to staff engineer in the technical division of Humble Oil & Refining Co.'s Humble division.

Kenneth Parrent, consulting engineer and geologist in Casper, Wyo., has joined English Oil Co., Salt Lake City, as production superintendent.

L. W. Henshaw, Jr., engineer with Union Oil Co., has been transferred to Woodward, Okla., from Perryton, Tex.

Leon L. Fergus, New Orleans district land man and staff assistant to the exploration manager of Sohio Petroleum Co., has joined Trunkline Gas Co. as superintendent of land.

N. H. Black, supervisor of retail development in the marketing department of Standard Oil Co. of Texas, has been named assistant sales manager, operations, in El Paso, Tex. He succeeds **F. E. Chapman,** who has retired after 38 years with the company.

H. P. Reardon, engineer with Gulf Oil Corp., has been transferred to Houston from Fort Worth.

ADVERTISERS

. . . in this issue

A

ACF Industries, Incorporated, W-K-M Division 23
Aluminum Co. of America 46, 47
American Cyanamid Company, Refinery Chemicals Department 11
Anderson Company, The V. D. 135
Association of Industrial Advertisers 120
Atlas Pipe Inc. 140
Atlas Powder Company—Aquaness Department 37

B

Baker Oil Tools, Inc. 103
Ball Brothers Research Corp. 122
Bendix Corporation, The 22
Bethlehem Steel Company 42, 43
Supply Division 14
Black, Sivalls & Bryson, Inc. 54, 55
Bovaird Supply Co., The 1

C

Cabot Shops, Inc. ..... Inside Back Cover
Chicago Bridge & Iron Company 107
Chiksan Company 10
Clark Bros. Co., One of the Dresser Industries 28, 29
Classified Advertising 162, 163, 164
Cook Machinery Co., Inc. 137
Corrosion Services Incorporated 149
Crose Perrault Equipment Corp. 123

D

Darling Valve and Mfg. Co. 45
Delta Air Lines 139
Dover Corporation—The W. C. Norris Manufacturer Division 132, 148
Dowell 128, 129, 138
Drilling Equipment Manufacturing Co. 136

E

Edward Valves, Inc. 79

F

Fairbanks, Morse 117
First City National Bank of Houston 36
First National Bank of Shreveport, The 137
Fisher Governor Company 49
Flamingo Hotel, The 135

G

Goodall Rubber Company 124
Goodrich Chemical Company, B. F. (Geon) 7
Guiberson Corporation 31
Gulf Oil Corporation 38, 39

H

Halliburton Company, ... Inside Front Cover 12, 13, 81
Hillman-Kelley 48
Huey & Co., S. E. 123
Hughes Tool Co. ..... Back Cover
Humble Oil & Refining Co. 3

I

Ingersoll-Rand 85, 86
International Nickel Company, Inc., The 56

J

Johns-Manville Corporation 33
Jones & Laughlin Steel Corporation 34, 35

L

Link-Belt Company 15
Lone Star Steel Company 114, 115

M

Macco Oil Tool Co. 130
Magnet Cove Barium Corp. 8
Martin-Decker Corp. 126
Martin Manufacturer, John N. 133
Minneapolis-Honeywell Regulator Co., Industrial Division 16, 17
Mission Mfg. Company 41

N

National Tank Company 166
Naugatuck Chemical Division of United States Rubber Company 77
Newport News Shipbuilding and Dry Dock Company 30
Norris Manufacturing, W. C., Division of Dover Corporation 132, 148

O

Odex Engineering Co. 126
Ohio Injector Company, The 9
Oil Well Supply Division 4
Olin Mathieson Chemical Corporation, Chemicals Division 118
Orbit Valve Company 73

P

Parkersburg Rig & Reel Co. 24
Philco Corporation 18
Price Company, H. C. Pipe Coating Division 2

R

Reda Pump Company 137
Republic Supply Company, A Subsidiary of Republic Steel 6
Robbins Aviation, Inc. 130
Robbins & Myers, Inc. 147
Rockford Clutch Division of Borg-Warner Company 150
Roebling's Sons, John A.—Division of The Colorado Fuel and Iron Corporation 27
Rolo Manufacturing Company 14
Roper Hydraulics, Inc. 151

S

Society of Professional Well Log Analysts 152
Southwest Industries, Inc. 69
Staats & Co., William R. 156

T

Texaco Inc. 19
Texas Employers Insurance Association 5
Tinker & Rasor 119

U

Union Asbestos and Rubber Company, Fibrous Products Division 25
Union Carbide Chemicals Company, Division of Union Carbide Corporation 32
United States Rubber Company 77
United States Steel Corporation—Oil Well Supply Division 4

W

Welex, Inc. 52
Well Equipment Mfg. Corp. 44
Western Supply Company 26
Wheland Company, The 50
W-K-M Division of ACF Industries Incorporated 23
Worthington Corporation 20, 21

Z

Zink Company, John 131

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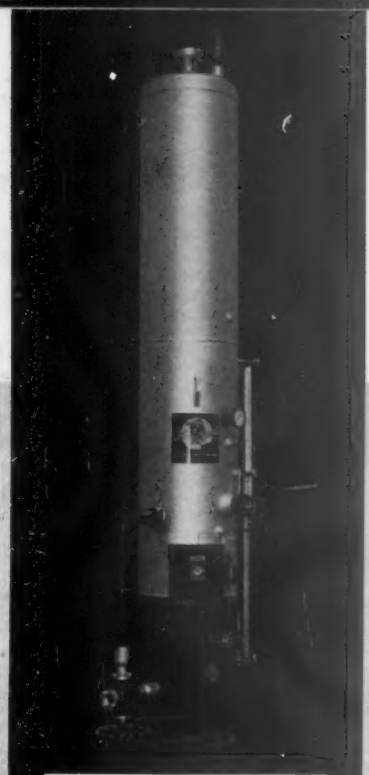
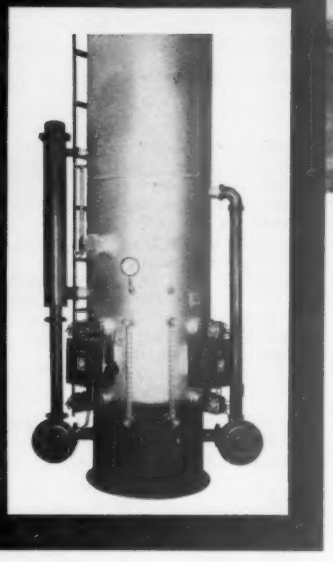
Patents Pending





National Two-Phase Metering Separator separates and measures production from individual wells for commingling.

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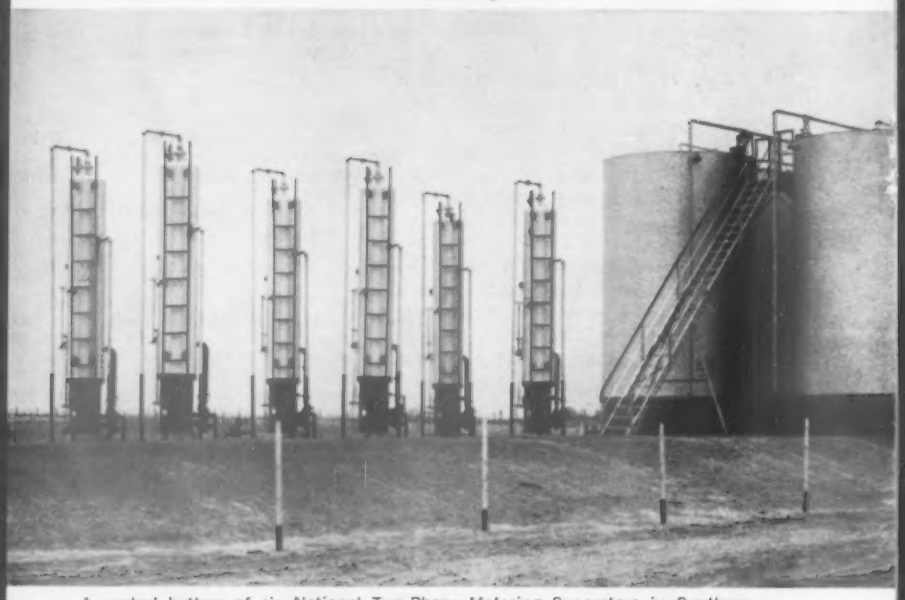
National Three-Phase Metering Separator for separating and measuring oil and water for individual well testing.



A central battery of six National Two-Phase Metering Separators in Southern Oklahoma, producing three wells, two zones each, commingling, into one tank battery. (Shown top.)

In The Separator Section

1. The long proven National Standard Gas Scrubbing Element assures liquid free gas.
2. A spreader plate insures degassing of the oil and provides the quieting section essential for efficient separation.
3. Ample storage of oil in a turbulent-free section provides stabilization and prevents carry-over during meter discharge period.

In The Liquid Metering Section
FEATURING NATIONAL'S NEW 3-WAY VALVE

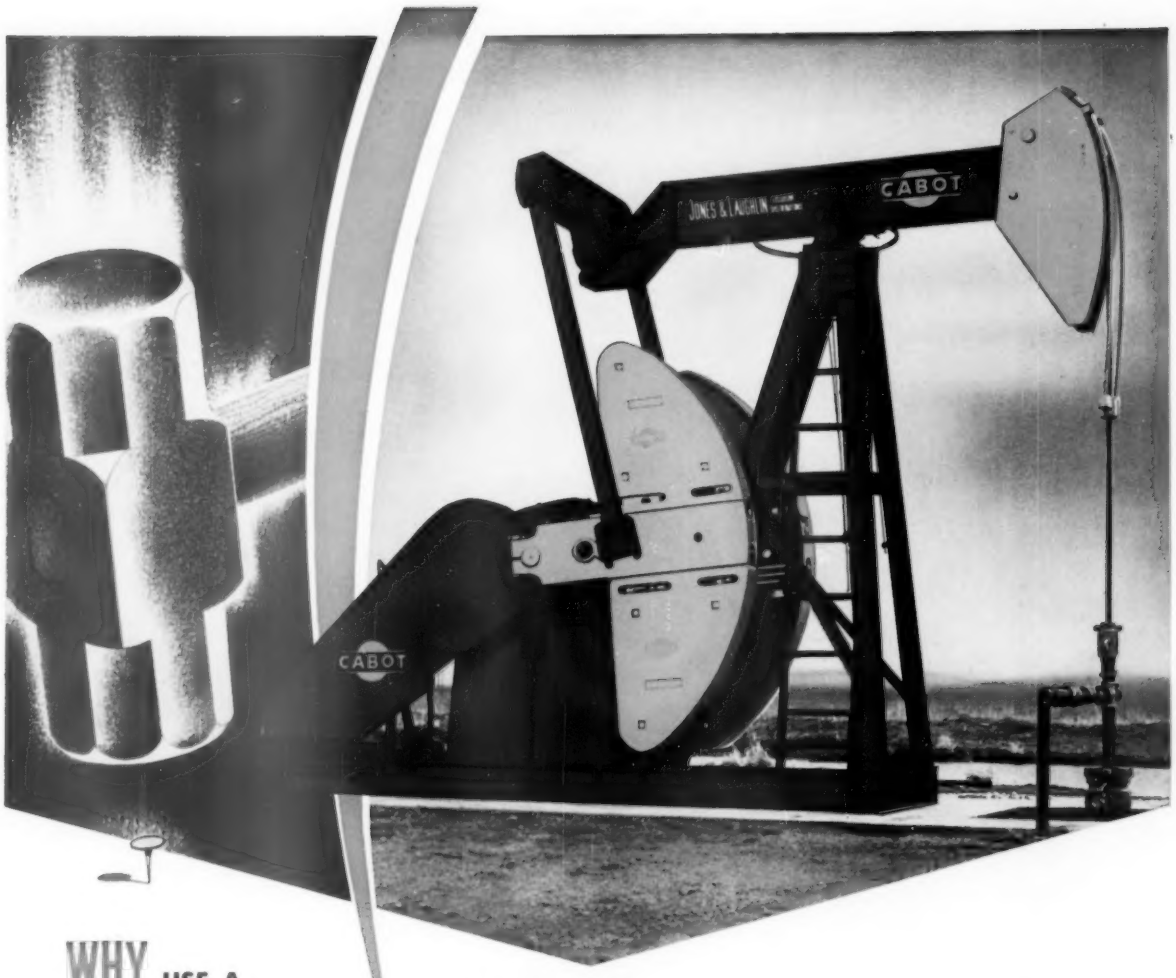
1. Surface area at both high and low level assures minimum metering error.
2. Two weather-proof, sensitive level controls operating in conjunction with a power booster and custom designed three-way valve guarantee the ultimate in accuracy obtainable for a meter which isolates a volume between level control points.
3. Prefabricated piping furnished for ease and speed of installation.
4. Counter records individual dumps of meter and is readily convertible to barrels run during the test.

A PLUS Value with all National Products . . . Engineers and field crews available from over 50 service and warehouse stocking points for complete units or spare parts to size, install and service National Metering Separators.

It's a National®

NATIONAL TANK COMPANY

DRAWER 1710
TULSA, OKLAHOMA



WHY USE A SLEDGE HAMMER TO DRIVE A TACK?

CABOT *SAYS:* SELECT THE EXACT SIZE UNIT FOR YOUR PUMPING NEEDS

Why spend more for a pumping unit than you need to? In today's oil economy this becomes an important sobering question. That's why Cabot aims at holding your pumping costs down . . . That's why Cabot builds reserve ruggedness in every unit and then backs these units with 24-hour field service.

More and more producers have come to realize that the "Cabot Habit" is the sensible answer to economy and operating demands.

CALL YOUR J&L MAN...

OIL FIELD PUMPING EQUIPMENT
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PAMPA, TEXAS
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DIVISION OF CABOT

Hughes engineered bit programs are lowering hole time and bit costs—from Alberta to Louisiana

Every week, new field reports tell us how Hughes Engineered Bit Programs are cutting drilling costs.

In case after case, results have proved that in any formation, where the *right* bits are run with the *right* combination of weights, rotary speeds and hydraulics — hole time can nearly always be lowered. And the number of bits reduced!

There's an experienced Hughes field representative in your area who will be glad to work with you in setting up a *cost-saving* bit program for your next well — a service that is made possible through the use of Hughes bits.

Here are some recent examples of savings made with Hughes Engineered Bit Programs:

Alberta, Canada: Time to drill 10,000-foot well was reduced from 402 to 252 hours; the number of bits from 43 to 22.

Norman, Oklahoma: Five days cut from time required to drill an 8800-foot well; 14 fewer bits used.

Meade County, Kansas: On comparative 4200-foot wells, drilling time was reduced by 4 days; cost per foot of hole by 19 percent.

San Juan County, New Mexico: Following Hughes program, contractor lowered cost per well by $5,000.

Vermillion Parish, Louisiana: Over 100 hours trimmed from the best previous time in drilling 12,000-foot wells.

HUGHES TOOL COMPANY

ORIGINATOR AND WORLD'S LEADING DEVELOPER OF CONE-TYPE ROCK BITS